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COMPUTE

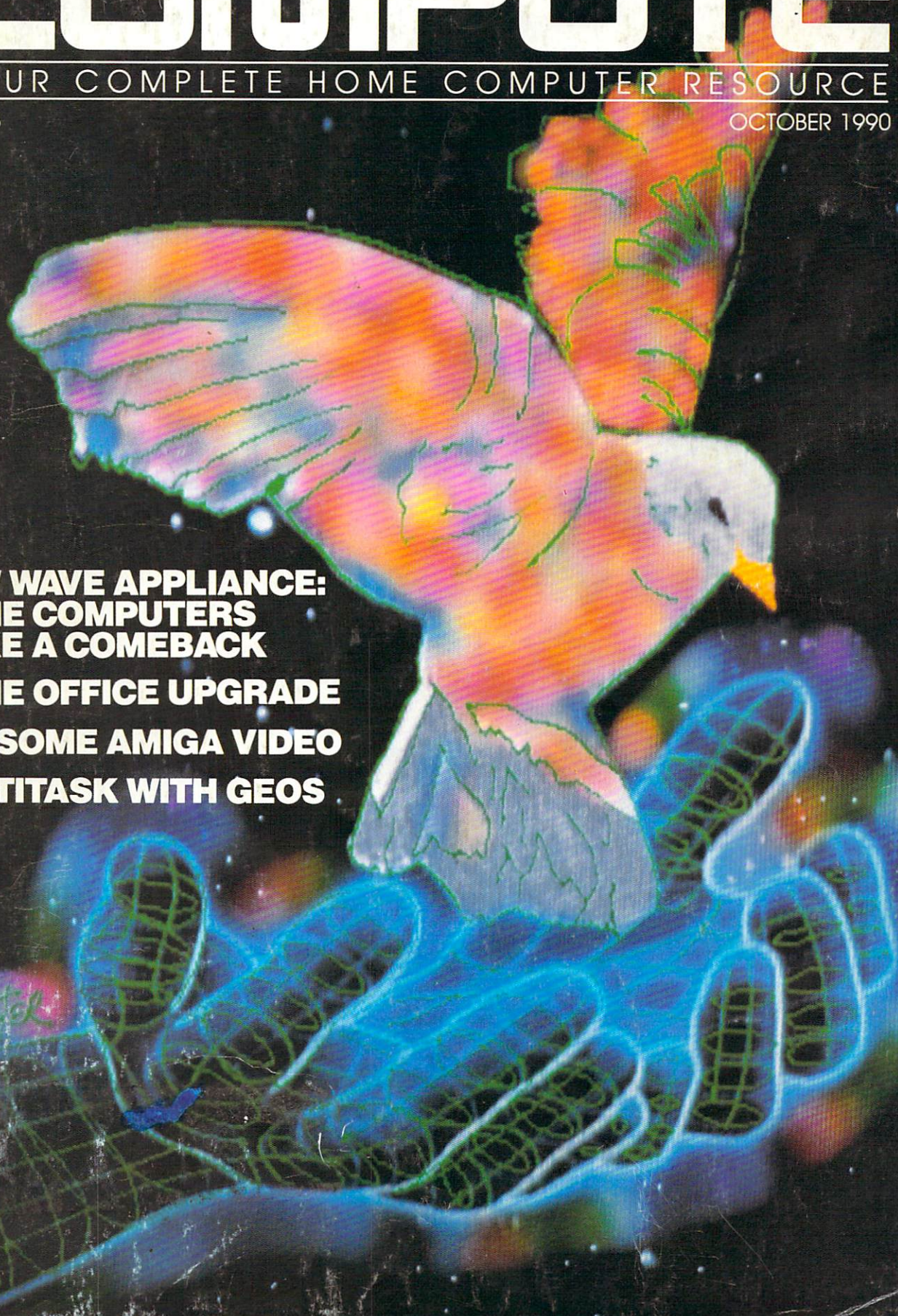
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COMPUTE

OCTOBER 1990

VOLUME 12 • NO. 7 • ISSUE 122

GAZETTE SUBSCRIBER EDITION

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64/128 VIEW

T O M N E T S E L

A funny thing happened to *Gazette* on the way to the printer this month. Actually, it began several months ago, when COMPUTE! Publications' parent company, Capital Cities/ABC, decided to divest itself of its consumer magazine division. *COMPUTE!*, *COMPUTE!'s Gazette*, *COMPUTE!'s Amiga Resource*, and *COMPUTE!'s PC Magazine* were up for sale.

That's when General Media came to the rescue. COMPUTE Publications (without the exclamation point) now joins the firm that publishes *Omni*, *Penthouse*, *Longevity*, and *Four Wheeler* magazines. With the buyout, however, came a major restructuring.

We no longer produce four separate products. Instead, we publish one basic magazine, *COMPUTE*, with separate machine-specific editions for owners of Amigas, PCs, and 64/128s. In this way, subscribers get the computer-specific information they've come to expect plus entertaining and informative *COMPUTE* features, articles, and reviews dealing with the personal computer world at large.

While the name on the cover is different, I think 64 and 128 owners will find that *Gazette* has retained its identity. Look through this issue and you'll see many of your favorite columns and features—and yes, we still have the type-in programs for *Gazette* subscribers and newsstand buyers.

There have been changes, however. For many years Lance Elko edited *Gazette* magazine, and, although he did an outstanding job, Lance felt the time had come for him to pursue other interests. We wish

him the best. This issue marks my debut as editor, and I'll do my best to continue with the tradition of excellence that Lance fostered and maintained.

As for the contents, they have changed little. "Feedback" and "Letters to the Editor" have been combined into one column, now called "Feedback." This is where we'll try to answer your questions and publish your suggestions, comments, tips, quips, and gripes.

To find out what's new in the 8-bit world of Commodore, check out "News & Notes." Formerly called "Commodore Clips," this is where we'll announce new software and hardware, the latest facts and rumors from Commodore, and other items of interest to 64 and 128 owners.

Returning are many of your favorite columnists. Larry Cotton's tutorial on BASIC programming and Jim Butterfield's machine language

series are both here. Also continuing are Randy Thompson's "Programmer's Page" and "D'Iversions," Fred D'Ignazio's look at technology.

"The GEOS Column" has been a semiregular feature, but since many of its articles are submitted by readers, we'll need your help if it is to remain. We do have a few surprises coming up for GEOS fans, but we still need to hear from you.

We also want to hear from BASIC and machine language programmers. Just as in the past, if you write original 64 or 128 games, utilities, or productivity programs, keep those submissions coming. The type-in programs have always been an integral part of the *Gazette* concept, and we want to continue bringing you the best in original programs. Of course, those programs are also available on the *Gazette Disk*.

We're also looking for authors to write articles, features, and reviews. If

you have expertise in a certain field and can communicate that knowledge, we'd like to hear from you. We also need computer artists (see "News & Notes" in this section).

We want the *Gazette* pages to remain a major resource for 64 and 128 users, but we need your help. Whether you're into telecommunications, desktop publishing, graphics, music, programming, or game playing, all of you dedicated 64 and 128 users constitute a vast wellspring of information. We want to tap this wealth of knowledge and share it with all our readers. With your help and support, we at *Gazette* will do our best to meet your computing needs into the next decade. □





NEWS & NOTES

CALLING ALL ARTISTS!

Is there a Rembrandt or van Gogh inside you, trying to get out? If so, we want to see your 64/128 masterpieces. Starting with the November issue of *Gazette Disk*, we'll publish the best examples of original 64/128 art submitted by our readers. Five top entries will appear each month in the "Gazette Gallery," a new feature found only on the *Gazette Disk*.

Send your *Doodle*, *Koala*, or other popular 64/128 paint-program

pictures to the address below. (No more than five submissions per disk per month, please.) We pay \$50 for each piece of art we accept and \$100 for the one we judge Picture of the Month. Enclose a self-addressed, stamped disk envelope if you want your disk returned.

Gazette Gallery
COMPUTE Publications
324 W. Wendover Ave.
Greensboro, NC 27408

War Strategy

Strategic Simulations (675 Almanor Avenue, Sunnyvale, California 94086) has released *War of the Lance* (\$39.95), the first Advanced Dungeons & Dragons strategic war game for the Commodore 64. Set in the Dragonlance game world, this one- or two-player game requires you to make alliances, conquer nations, and destroy enemy troops.

You command the Whitestone forces of good against the evil Highlord Dragonarmies. The full campaign lasts for six game years, which takes 30 turns. You may engage in battles to conquer enemy countries or try to gain alliances by sending diplomats. Representatives of your armies can also be sent on quests for magic that will make your forces even more powerful.

A strategic map allows you to track the movements of the different armies. The zoom function permits you to direct the war on a tighter scale. You can watch the details of battle by selecting the tactical view.

—MICKEY McLEAN

Own Your Own Stables

Owners of *Omni-Play Horse Racing* from SportTime Computer Software (3187-G Airway Avenue, Costa Mesa, California 92626) can now expand the playing style and graphics of their game with the *Stable Owners* option module (\$19.95). It's one of several modules scheduled for release. The modules allow you to customize your game, making it as basic or as complex as you desire.

With *Stable Owners*, you add a new perspective to the game by joining the elite class of thoroughbred owners, giving you control over the destiny of your own horses. Put together your own personal stable of Claiming, Allowance, and Stakes horses. Hire jockeys and match their skills against the competition as you enter them into the races of your choice. Up to four players can participate.

—MICKEY McLEAN

Dinosaurs, Business, and Tennis

DigiTek Software (8910 North Dale Mabry, Executive Center, Suite 37, Tampa, Florida 33614) has announced three new products for the 64/128: *Dinowars*, *Big Business*, and *Tie Break Tennis*.

Dinowars (\$29.95) is a combination of a strategy-board game and an arcade-action adventure. Also included is an animated encyclopedia and an action-only mode. Players control any of eight different dinosaurs, each with its own strengths and weaknesses, in combat over a kidnapped dinosaur egg. The game features massive dinosaurs that stand as tall as two-thirds of the screen.

For competition with a more current flavor, try *Big Business* (\$29.95), a humorous simulation of a large manufacturing company. Three players each start with equal assets and market the same product, competing to acquire the greatest net worth by game's end. While some aspects of the game are strictly entertaining, the core of the program is an accurate economic model. Factors such as interest rates, inflation, market climate, prices, and availability of raw materials are calculated.

When you're ready for a little exercise, step onto the court for *Tie Break Tennis* (\$29.95). This realistic tennis simulation puts more than a dozen techniques at your disposal: crushing serves, forehand, backhand, topspin, slice, lob, overhead play, slam, volley, passing shots, drop shots, and soft balls. The game features speech and sound effects and a TV-style presentation. Play singles, doubles, or tournaments on clay, grass, or asphalt, and even select your choice of racquets. Compete against a computer or human opponent.

—TOM NETSEL

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- Commodore 1541 Disk Drive
- Commodore Color Printer
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- 10 Diskettes

\$339

PERIPHERALS FOR COMMODORE

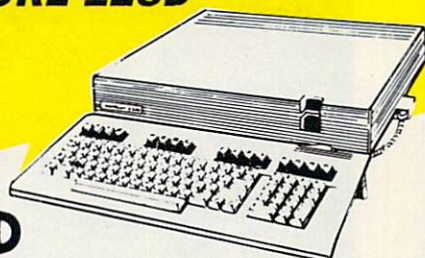
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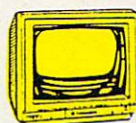
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- Commodore Color Printer
- 12" Monitor

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- Commodore 128D Computer with Built-in Disk Drive
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- Commodore Color Printer

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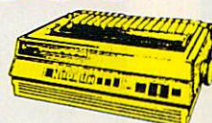
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SEE OUR AD IN THIS MONTH'S AMIGA SECTION OF THIS MAGAZINE FOR GREAT AMIGA SPECIAL VALUES



DIDIER CREMIEUX

MAIL-ORDER MAZE

BUYING SOFTWARE AND HARDWARE BY MAIL IS EASY, IS CONVENIENT, AND CAN SAVE YOU MONEY. BUT THERE ARE SOME TIPS YOU SHOULD KNOW BEFORE YOU PLACE AN ORDER.

M I C K E Y M c L E A N

Because of our busy lifestyles, mail order's convenience makes it an attractive alternative to driving out to the shopping mall and fighting for a parking place. Computer users were taking advantage of mail order long before it was chic to have Lands' End and L. L. Bean catalogs stacked on your coffee table. It's also a good way to save money and locate hard-to-find items.

If you glance at computer magazines from the past ten years or so, you'll notice a multitude of companies selling products with an 800 order number—but much has changed

over the past decade. Mail order had a bad name years ago, mainly because of a number of unscrupulous dealers who deceived consumers. The U.S. Postal Service responded by cracking down on this type of activity, forcing many unscrupulous dealers out of business. As a result, the mail-order business has gained a new respectability in recent years.

This doesn't mean you should throw caution to the wind, but now you can order products with confidence and usually receive a guarantee that you'll be completely satisfied or get your money refunded.

Reputation

Before shopping for the software or hardware you need, seek out a dealer who best meets your needs.

"Check out the reputation of a company," says Les Lawrence, president of Software Support International. "Watch the company's advertisements, and find out how long they've been in business."

Mark Lane, manager of Software Discounters of America, agrees, "The bigger the company, the bigger the ad, and the longer they've been in business, the more you know what kind of commitment they have."

Other factors to consider are the type of guarantee offered, the return policy, how fast products can be delivered, and the knowledgeability of the staff. Whether or not a company accepts your credit card, ships C.O.D., offers rush service, or ships to military or international destinations could also be important to you.

Friends, co-workers, or fellow user-group members can be a good source of information. Ask around and find out which companies they've had success with.

"Not all companies are alike," says Janet Brito, president of Briwall. "And there are not many left to choose from in the Commodore market."

Lane says that since the 64/128 market's days are numbered, consumers should look to a company that already carries multiple formats.

"I carry all formats, therefore I don't have to run away from the Commodore market," he says. "I'll stick with it. I'm not sure others will stick around, but I'll try hard to get all the new titles I can."

Price vs. Service

The first thing most consumers look for in a mail-order ad is the price of the product and how it compares with what other mail-order firms or the local computer store is offering.

When dealing with mail-order companies, comparing prices has added importance. For example, several companies will match any current nationally advertised price on the exact same item less shipping and sales tax. The only stipulations are that the product has to have been advertised recently and you must be able to verify its price.

Briwall's Janet Brito believes that low prices are important but should not be the most important factor when you're choosing between mail-order companies.

"There are some mail-order companies out there that advertise products at the cheapest price, and that's all they'll give you," she says. "I get

This list of tips from representatives of major mail-order houses should help you get through the ordering process with few or no problems.

1. If you have detailed questions about a product or the company, call the customer-service or technical-support telephone number, not the order number.
2. Place your order during normal business hours, when the company is better staffed and able to answer your questions.
3. To receive prompt service, it's best to call in midweek (Monday and Friday are the busiest days for orders).
4. When comparing prices between companies, be sure to add in all shipping costs and credit card surcharges.

very irritated when people call just to compare prices. They don't consider other factors such as service and support. They need to be a little less concerned about pricing and think about how they're being treated after they've ordered."

On the other hand, Les Lawrence believes low prices are the main reason why consumers use mail order and that they should not expect much beyond that.

"Customers have to realize we have cut prices to rock bottom," he says. "They shouldn't always expect free customer support and 100-percent satisfaction. It's difficult at the

5. Be prepared to pay sales tax should you reside in the same state as the mail-order company.

6. Look for a company that has a computerized inventory so you can find out immediately if a product is in stock.

7. Determine whether a company charges your credit card before shipping the product.

8. Make a note of the name of the company you ordered from, the date you placed the order, the total price of the order, and the name of the person who handled your order.

9. Value good service and after-sale support more than unit price.

10. If a company has served you well in the past, stay loyal.

prices we charge. Somebody has to pay the bill."

Lawrence also believes that customers have a responsibility to research the market well and know what they want before ordering.

"Customers should go into a purchase with eyes wide open and know what they're buying before they buy—they shouldn't play games with mail order."

Piracy Problems

Software piracy has hurt the computer industry in more ways than one, and publishers are not the only ones who have suffered. The practice of illegally copying games has put a large dent in the mail-order trade and has changed the way some are doing business.

Janet Brito says that she started noticing people purchasing four or five games at a time from her company and then returning them a few weeks later. After repeated instances of this suspicious behavior, the company decided to change its return policy.

"We've stopped taking back entertainment titles because of the copying," she says.

Brito adds that despite this change in policy, the company will consider issuing a refund on an entertainment title if a customer has a legitimate beef.

Operators Standing By

After digesting the information in this article and the reference guide on page 6, you should be able to go to the mail-order ads in this magazine, make comparisons, and place an order with confidence. Who knows? You may find it so easy that you'll never set foot in a shopping mall again. >

FRIENDLY TIPS

BE PREPARED

Before placing an order with a mail-order company, be ready. You can save yourself and the company a lot of time.

1. Read the company's ad carefully and take note of its ordering, payment, shipping, and return policies. If you have any questions about its policies, ask before you order.
2. Know which products you want to order, including any specifications.
3. Write down any questions you have about your order.
4. If you're paying by credit card, have your card number, expiration date, and the name of the cardholder in front of you.
5. Have the proper shipping address ready. If a company ships primarily by UPS, you'll need to provide a street address (a post office box number is unacceptable).

MAIL-ORDER REFERENCE GUIDE

The following grid lists the services and policies of six of the major mail-order houses in the 64/128 market.

This chart contains information obtained from advertisements and company representatives. It should be used strictly as a reference. Company policies are subject to change, and there may also be some exceptions to stated rules and regulations. It is recommended that you contact each company to make direct inquiries concerning policies that interest you and will apply to your order.

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ACCOLADE

Blue Angels Flight Sim\$19

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JN Golf Int'l Courses\$9.88

Steel Thunder\$14

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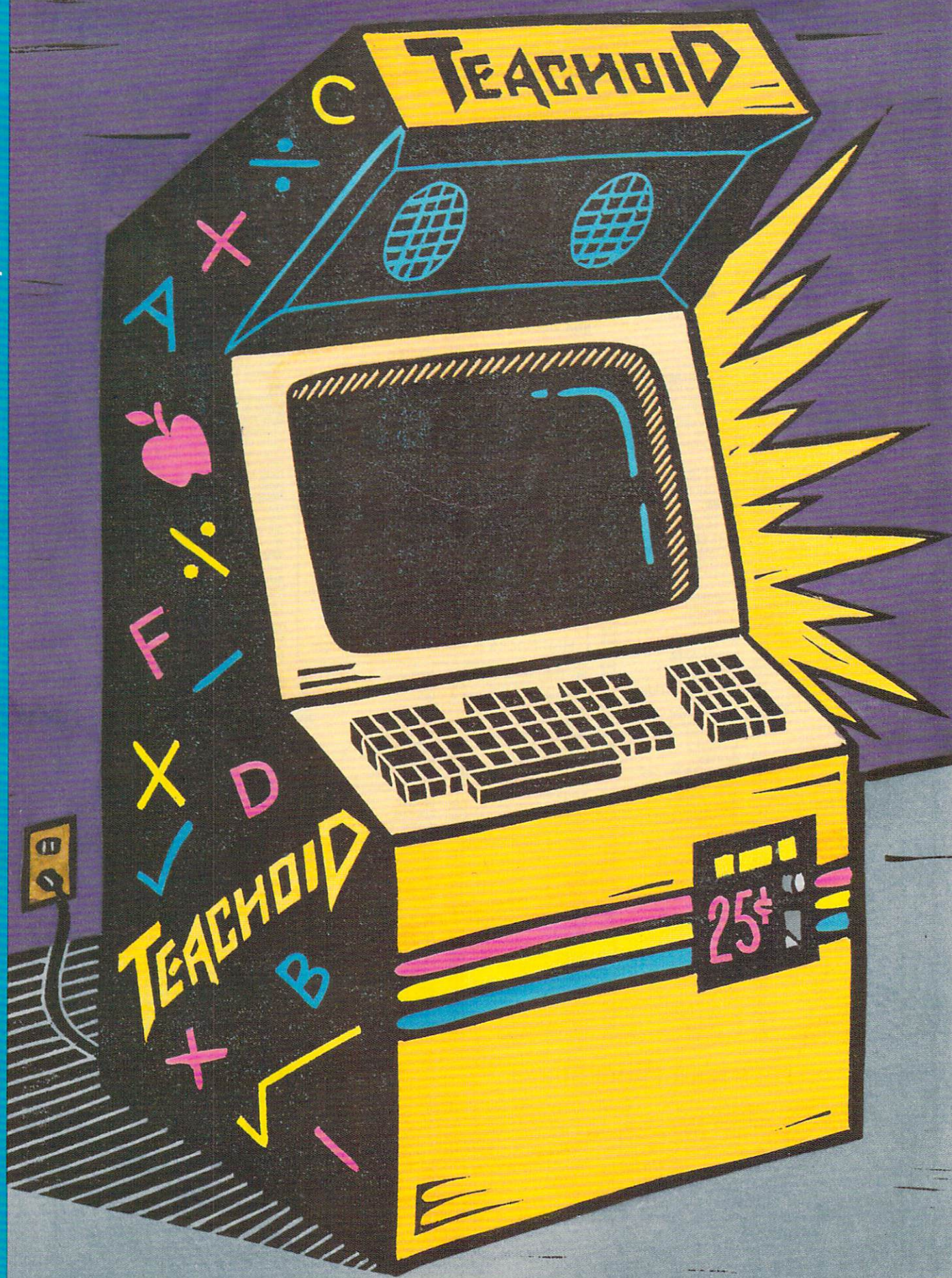
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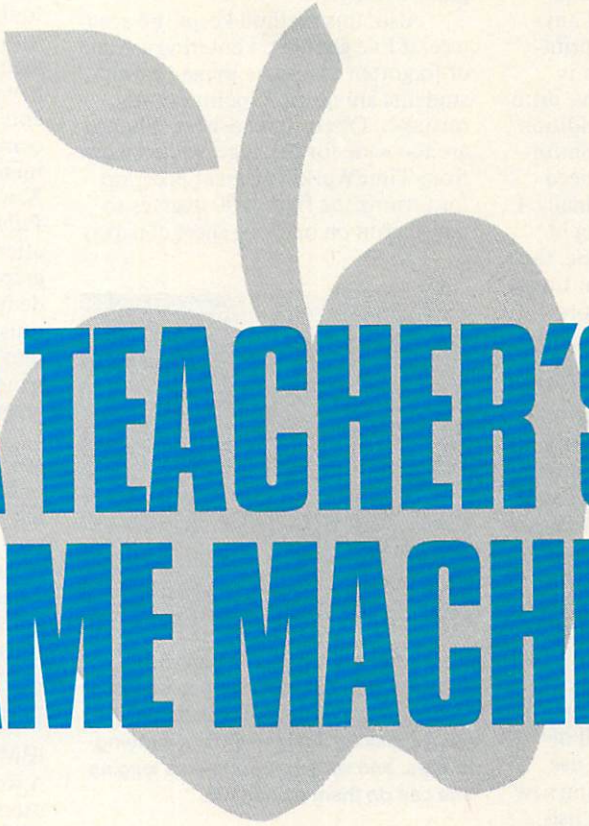
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A TEACHER'S GAME MACHINE

D O R O T H Y H E M M E

Commodore is a game machine, right? Well, I don't play many games, at least not the joystick, shoot-'em-up variety. I leave those to my 14-year-old son. When I play "computer," I like to find and run useful programs that will expand my creativity and lighten my work load. That's a game to me—and it's fun.

So what can I do with my game machine? To borrow a cliché from literature: "How do I love thee? Let me count the ways." If you're an educator or a parent, you might count the ways, too. As a high school English teacher, I must grade volumes of paperwork and record those grades. Of course, I first have to generate the assignments so students can submit their papers to be graded in the first place. From generating assignments to helping me with dozens of other classroom tasks, the 128 makes my work a snap. In fact, handling chores such as these have become my favorite computer games.

Although I started my computer system with a 64, a 1541 disk drive, and a composite monitor, I upgraded several years ago to a 128, a 1571, and an RGB 80-column

monitor. I'll have to admit that the disk drives are slower than I like, so I also bought a Mach 128 cartridge for greater speed and two-key loading. That made a big difference.

First, the 80-column mode is ideal for word processing. Its higher resolution makes it much easier on my tired old eyes. Also, many word processors have a preview mode for 80 columns that doesn't require scrolling from side to side or shrinking the text onscreen. My handouts and tests have to be precise, and I don't have the time to print several versions to see exactly what any change or modification will look like. I like the convenience of the 80-column screen.

I have several word processing packages, including COMPUTE's *SpeedScript 128*, GEOS, and Professional Software's *Fleet System*. I use this last program most often because of its built-in spelling checker. I also like its flexible page

length, from three-line mailing labels to legal-size documents. Of course, I have all my tests, handouts, and notes on disk, and this makes inserting, cutting, and pasting information for new tests and assignments very easy.▷

COMMODORE—GAMES—FUN.
THESE THREE WORDS ARE LINKED
IN MANY PEOPLE'S MINDS, BUT
THIS TEXAS TEACHER FINDS HER
128 IS FUN EVEN IF THE GAMES
SHE PLAYS ARE DIFFERENT.

Next is the printer. The right printer is a must, but with all the printing chores teachers face, one printer is not always enough. I have a great Star SG10 dot-matrix printer that does a superb job on most anything from near-letter-quality printouts to graphics, and its ribbon is cheap. It prints through carbons, ditto masters, and NCR paper. In addition, I also have an old daisywheel Smith-Corona TP1 for times when I need true letter-quality printouts. Finally, I own an Okimate 10 for printing in color. In bold or enhanced mode, the Okimate will also print on clear transparencies for overhead projectors when the need arises.

Power User

Now, how about software? That's the heart of computing, isn't it? I don't do much programming, but I'm a power user of what others more gifted than I can create. After I've made an assignment with a good 80-column word processor or test generator and the students have turned them in, it's time to record their grades with a spreadsheet.

I have downloaded dozens of public domain programs from Q-Link, including gradebooks. All of these programs have features I use each six weeks when I'm creating new roll sheets for temporary grade listings, for progress reports I send to students' homes, and for seating charts. However, the spreadsheet I particularly like is the Epyx version of *Multi-Plan* in both 40 and 80 columns.

I'm required to average grades every three weeks for all of the students I teach, including those governed by the University Interscholastic League for extracurricular activities. *Multi-Plan* does the averaging and helps me spot potential problems. If grades suddenly drop, deficiency reports go out. These reports help parents and other teachers become aware of any learning difficulty a student may have before it gets out of hand.

I also need averages at the end of the six-week grading period for report cards. I can't see spending time averaging grades for 150 students from scratch every three weeks on a calculator—not when my computer averages and saves it all. It all boils down to saving time.

There are always students who forget to do assignments or fail to make up work when absent. *Multi-Plan* allows me to create a spreadsheet with headings that literally spell out what the assignment was, what the grade was, and if it was a daily or a major grade. I post these grades on the bulletin board by student ID number—no names, please! This usually

gets them to make up the missing work. It's amazing how quickly students want to get something done when they see how zeros affect their grade averages.

Also, this method keeps me accurate. If I've goofed on entering a grade or forgotten to update make-up work, students are quick to point out my mistakes. Often, spreadsheet columns are too wide for the page, so *Sideways* from TimeWorks is a great program for turning the figures 90 degrees so they'll print on one long sheet of paper.



Most teachers regard the paperwork associated with the teaching profession as a chore. But Dorothy Hemme actually enjoys making assignments, averaging grades, and writing reports—as long as she can do them on her 128.

Notice This

In addition to helping with my administrative chores, the computer helps me grab the kids' attention. We use Brøderbund's *Print Shop* and Unison World's *Printmaster* for signs around the room dealing with novels and characters. I also print individual signs and have them laminated for each passing student who is engaged in an extracurricular activity such as football, choir, or drill team. These signs are posted on a wall in a special area of my classroom.

Banners grab students' eyes and draw attention to coming attractions at school. The Okimate helps with the artwork. I quit oil painting years ago when I ran out of room at home and my small kids were into everything, but now I create pictures with a light pen and print them with the Okimate.

And how do I reward my students for a job well done? I print blank certificates with Spinnaker's *Certificate Maker* and then run them off on the school's photocopy machine on blue paper—our school color. I buy the paper by the ream at an office supply store with my own money. I fill in the students' names and then hand out certificates for every excellent essay, for those who make the honor roll, for improve-

ment, and for students who worked hard on certain projects.

For Excellence

In addition, I send my own newsletter to the students' homes. Yes, I am also into desktop publishing. At appropriate times during the year, I publish a newsletter for students and their parents to let them see what we've accomplished in class. After experimenting with *Newsroom* and *Personal Newsletter*, I switched to *Paperclip Publisher* from Electronic Arts shortly after it arrived on the scene. I include graphics and as many names of students achieving excellence as I can muster. Students and parents tell me that these newsletters and certificates wind up on refrigerator doors and are great for brownie points with parents.

Being the computerphile that I am, I recently invested in Berkeley Software's *geoPublish*, but only after buying the 512K *geoRam*. Again, for me the irritation of the Commodore is its lack of speed, not its capabilities. After experimenting with *geoRam*, I know that the cartridge will save me considerable time, since I won't have to wait for text and clip art to load from disk every few seconds.

IBM? Who Needs It!

A word to IBM PC clone and Mac users: Sure, more than likely you have greater memory and greater speed—I envy those features. Talk of 286s and 386s and what they can do is heady stuff, and I love Mac graphics, but you paid more for your system. As an underpaid educator, however, I cannot afford such things—but I've found I don't need them.

Commodore garnered the low end of the computer market early because most home computer users could not afford expensive office machines. Over the years, I've spent quite a few hard-earned dollars for my machines and peripherals, but it has always been to upgrade the same machine. I've never felt the need to buy a new brand.

By now, if you still think the Commodore is a game machine, perhaps you're right. I'll admit I play with my 128 every night, and I have a lot of fun with it. While I might not blast aliens or search for treasure in monster-infested dungeons, I do get a kick out of the "games" I play with my computer. It's not my fault if some people insist on calling it work. ☐

Dorothy Hemme teaches 11th grade English at Clements High School in the Fort Bend School District in Sugar Land, Texas. In 1984, Hemme hooked a 64 to a black-and-white television and booted her first word processor. She hasn't touched a typewriter since.



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FEEDBACK

QUESTIONS FROM OUR READERS

Muddled Math

The June table of contents lists *Mudfrog Math* as a program for the 64, but the lead-in for the article says it's for the 128. The article itself says nothing about which machine the program is for. When I run the menu from the *Gazette Disk* with my 64, the program isn't listed, but the program appears when I list the directory. When I try to load it using the program name, I get an error message. What's the problem? Is the table of contents or the lead-in wrong? Is the disk screwed up?

IVAN BORTNER
BOILING SPRINGS, PA

Sorry, Ivan, we goofed when we compiled the table of contents. Mudfrog Math is for the 128 as stated in the lead-in, and since the program is written in BASIC 7.0, it will not run on the 64. I guess our name is mud!

Ham Aid

Here's an idea for a new column. It's a cross between *This Old House* and *On the Road*. It could be called *This Old Computer*. People would come up with ideas and you'd send an expert to give them a hand.

To start it off, I'd like to see some programs that help amateur radio hobbists—perhaps a calculator that gives you the number of turns and wire gauge needed for a radio-frequency coil. Maybe your expert could whip up a program that would help me receive teletype or ASCII signals over my shortwave radio.

TERRY M. SUTLIFF
ORANGEVILLE, PA

We have experts like you mentioned, Terry. They're called our readers. We'll be glad to pass on any tips they can provide.

Secret Color Memory on the 128

I have written a short and simple sketch program for my Commodore 128 running in graphic mode 4 (multicolor bitmap mode). I am having

trouble saving the picture after I draw it. When I BSAVE locations 7168–16384, it stores the picture and colors 0, 1, and 2, but not color 3. I know there must be a place where it is stored, because several colors for color 3 show up on the monitor. Can you help?

MATTHEW BOARDMAN
CHESTER BASIN, N.S., CANADA

In multicolor bitmap graphics, the information for color 3 is stored in color memory at 55296. On a 64, that's the end of the story. However, the 128 has two separate banks of color memory—one for the hi-res multicolor bitmap color 3 and the other for normal screen memory. In the simple sketch program that follows, locations 216 and 1 are manipulated to get at the bitmap color memory. The command POKE 216,255 turns off the screen interrupt that generates the split-screen display, while POKE 216,0 turns it back on. Memory location 1 contains a data direction bit that indicates read or write.

The program that follows is for the Commodore 128 and requires a joystick plugged into port 2. Use the number keys 0–3 to select a pen. Move the joystick to draw. Press + or – to change the pen color. Press C to clear the screen. Select color 0 or hold down the fire button to erase. Press L for load and S for save.

The program creates two files, distinguishable by their filename extension, for each picture saved. The 37-block file with the extension .BIT contains the bitmap and colors 0, 1, and 2. The 5-block file with the extension .COL contains the color 3 information.

```
EX 100 REM SIMPLE 128 SKETCH P
      ROGRAM{2 SPACES}1/89 FE
      EDBACK
DC 110 GRAPHIC 4,1
JG 120 DIM C(3),DX(8),DY(8):C(
      0)=12:C(1)=7:C(2)=2:C(3
      )=15
HQ 130 DY(1)=-1:DX(2)=-1:DX(8)
      =-1
```

```
CP 140 DX(6)=-1:DX(7)=-1:DX(8)
      =-1
HJ 150 DY(4)=1:DX(5)=1:DX(6)=1
JB 160 DX(2)=1:DX(3)=1:DX(4)=1
QG 170 REM S = SPEED OF THE PE
      N
HE 180 S=3:FOR I=0 TO 8:DX(I)=
      DX(I)*S:DY(I)=DY(I)*S:N
      EXT
CS 190 MX=160:MY=160:CN=1
AP 200 X=MX/2:Y=MY/2:FOR I=0 T
      O 3:COLOR I,C(I):NEXT
AK 210 GRAPHIC 4,0:PRINT"{CLR}
      ":FOR I=1 TO 20:PRINT:N
      EXT
SH 220 PRINT"0,1,2,3 TO SELECT
      PEN"
RA 230 PRINT"+ {5 SPACES}CHAN
      GE PEN COLOR"
FQ 240 PRINT"L LOAD{2 SPACES}C
      CLEAR"
QP 250 PRINT"S SAVE{2 SPACES}E
      EXIT"
DM 260 REM MAIN LOOP
AF 270 T=JOY(2):IF T>0 THEN 31
      0
GC 280 REM GET KEY PRESS WHEN
      {SPACE}JOYSTICK IS STIL
      L
GX 290 GETA$:IF A$<>" THEN 38
      0
JH 300 GOTO 270
RC 310 X2=X:Y2=Y
KB 320 F=T>127:T=T+F*128:F=1+F
RA 330 X=X+DX(T):Y=Y+DY(T)
HH 340 IF X>MX OR X<0 THEN X=
      X2
EQ 350 IF Y>MY OR Y<0 THEN Y=
      Y2
RH 360 DRAW CN*X,Y TO X2,Y2
EQ 370 GOTO 270
DA 380 A=VAL(A$):IF A$="0" OR
      {SPACE}A>0 THEN CN=A:GO
      TO 270
HG 390 IF A$<>"+" THEN 430
CB 400 REM INCREASE PEN COLOR
DG 410 C(CN)=C(CN)+1:IF C(CN)>
      16 THEN C(CN)=1
JS 420 COLOR CN,C(CN):GOTO 270
MS 430 IF A$<>"-" THEN 470
FF 440 REM DECREASE PEN COLOR
XQ 450 C(CN)=C(CN)-1:IF C(CN)<
      1 THEN C(CN)=16
JK 460 COLOR CN,C(CN):GOTO 270
XA 470 IF A$="E" THEN GRAPHIC
      {SPACE}CLR:PRINT"{CLR}"
      :END
MD 480 IF A$="C" THEN GRAPHIC
      {SPACE}4,1:GOTO 210
MH 490 IF A$<>"S" THEN 600
CJ 500 REM SAVE FILE
HJ 510 GRAPHIC 0,0
EG 520 F$="":PRINT"{CLR}":INPU
      T"SAVE NAME";F$
JK 530 IF F$="" THEN 210
DS 540 F1$=F$+".BIT"
```


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FEEDBACK

continued from page G-12

```

HH 550 F2$=F$+".COL":GRAPHIC 4
,0
RS 560 BSAVE (F1$),B0,P7168 TO
P16384
BF 570 BANK 0:POKE 216,255:POK
E 1,PEEK(1) AND 254:BA
N K15
HR 580 BSAVE (F2$),B15,P55296
{SPACE}TO P56320
AG 590 POKE 216,0:POKE 1,PEEK(
1) OR 1:GOTO210
BP 600 IF A$<"L" THEN 270
KK 610 REM LOAD FILE
KB 620 GRAPHIC 0,0
QA 630 F$="":PRINT"{CLR}":INPU
T"FILENAME FOR LOAD ($
{SPACE}FOR DIR)":F$
JA 640 IF F$="" THEN 210
CB 650 IF F$="$" THEN GRAPHIC
{SPACE}0,0:DIRECTORY:GE
TKEYF$:GOTO630
FE 660 GRAPHIC 4,0
KP 670 BANK0:POKE 216,255:POKE
1,PEEK(1) AND 254
RJ 680 F1$=F$+".BIT"
DK 690 F2$=F$+".COL"
QE 700 BANK15:BLOAD (F2$),D0,P
55296
GH 710 BLOAD (F1$),D0,P7168
DS 720 GOTO210
    
```

Plus/4 Software Sources

For readers who want sources of Plus/4 software, send me a self-addressed, stamped envelope. I will send them a list of suppliers plus information about a newly formed user group called the Plus/4 Forum. I just joined, and Forum will send new members a disk of public domain programs.

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JOHN H. COLVIN
LOUISVILLE, KY

See the review of the 4-MHz Turbo Master CPU from Schnedler Systems elsewhere in this issue. Faster chips alone won't boost the 64's speed, but this plug-in card may do just what you want.

Do you have a question, comment, or problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, COM-PUTE, 324 West Wendover Avenue, Greensboro, North Carolina 27408. We regret that, due to the volume of mail received, we cannot respond individually to programming questions. □

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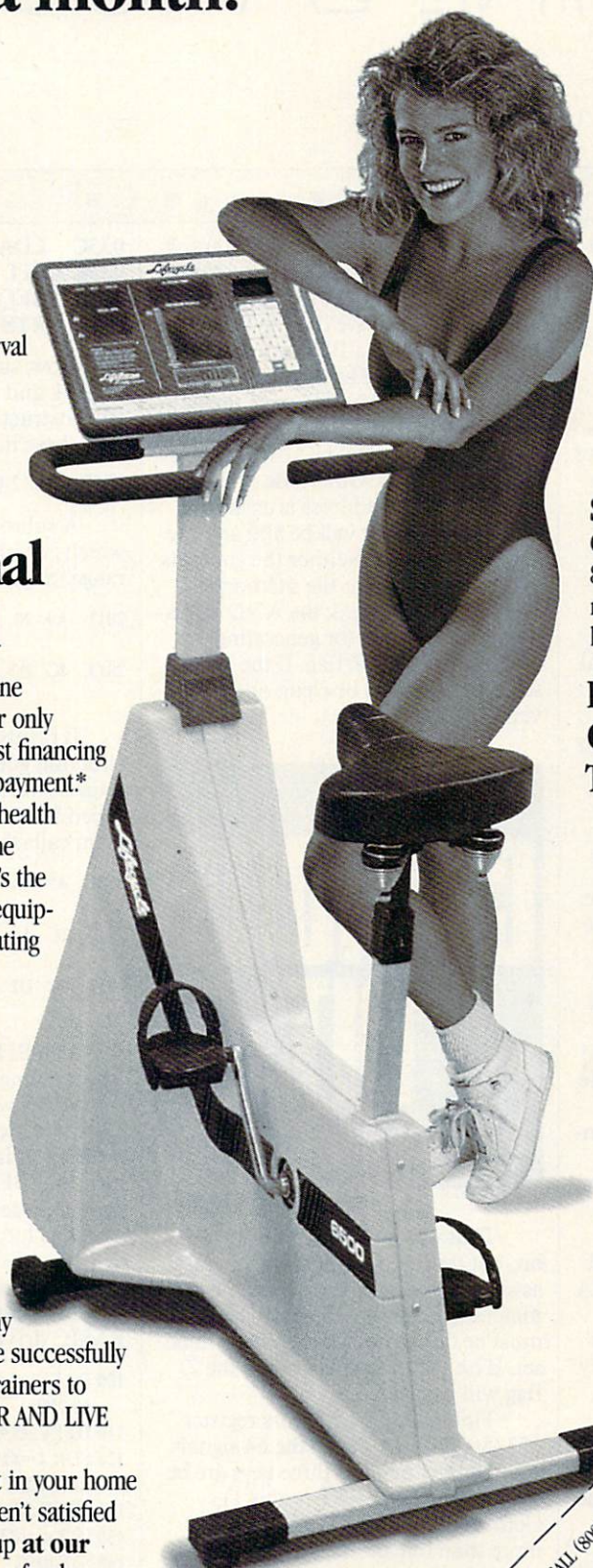
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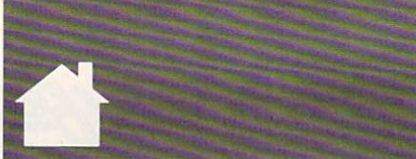
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MACHINE LANGUAGE

JIM BUTTERFIELD

The BIT command doesn't seem to fit in with the other 6502-based commands. It does a test that seems both complex and puzzling, and it has only two addressing modes: absolute and zero page.

BIT was designed to allow a program to quickly examine input/output (I/O) registers. Load a mask into the A register, matching the bit you want to test; execute the BIT instruction, addressing the I/O register you want to look at; then use the Z bit to tell you if you have a match.

No special addressing modes were added because designers felt that there'd be only a few I/O chips, each of which could be tested directly.

The BIT command automatically tests the two highest order bits of the selected address. No mask is necessary. The highest bit (bit 7) is copied to the N flag; a subsequent BMI will branch if this bit is set. And the second-highest bit (bit 6) is copied to the V (overflow) flag; a BVS will take the branch if this bit is set.

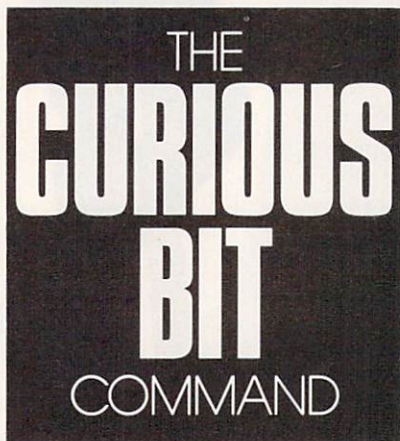
Bit 7 is tested because it's often used as the most important signal bit in a group. Interrupt registers often give it special status. Bit 7 is also used as a sign bit; turning on when the byte drops below 0.

Computer designers often put important connections at the two high bits so that they'll be easy to test with BIT. For example, the two most important input lines of the serial bus (serial in and clock in) are positioned in the two highest bits of the 6526 CIA #2 chip at address 56576 (\$DD00). We could monitor these with the BIT command without having to alter any data register—including the A register.

The formal description of the BIT command goes like this: The BIT instruction sets the N flag to the value of bit 7 of the memory being tested, the V flag to the value of bit 6 of the memory being tested, and the Z flag to the result of an AND operation between the A register and memory. (Z is set if the result is 0; otherwise it's

cleared.) We've looked at the N and V flags, but what's this AND situation?

Suppose we want to test the lowest bit (bit 0). We'd write LDA #\$01 followed by a BIT instruction with an address. The contents of the address will be ANDed with the value \$01; if its lowest bit is set, the result of the AND will be \$01 and the Z flag will be clear. Otherwise, if the lowest bit of the address is clear, the result of the AND will be \$00 and the Z flag will be set. Neither the contents of the A register nor the memory address will be changed; the AND operation is there solely for generating the right result in the Z flag. If the bit is set, the Z flag will be clear, and vice versa.



That was an example using one bit, but testing multiple bits is nearly as simple. Remember that *all* the matching bits in the memory address must be 0 in order for the Z flag to be set. If *any* of these bits are set, the Z flag will be cleared.

This example monitors register 653 (\$028D), which on the 64 signals whether any or all of three keys are being held down: SHIFT (value 1), Commodore (2), and CTRL (4). If more than one of these keys is being pressed, this location will contain the total of the numbers shown.

Here is a program that waits until *only* the Commodore key is pressed.

```
033C LDA #$02
033E BIT $028D
0340 BEQ $033E
0342 RTS
```

Now, suppose I need to print an asterisk and a space character. The BIT instruction can be used to combine these into a single routine:

```
200E: A9 2A 2C A9 20 4C D2 FF
```

A subroutine at address \$2011, which is within the above memory range, might be seen as

```
2011 A9 20 LDA #$20 ;space
                                character
2013 4C D2 FF JMP $FFD2 ;CHROUT
                                routine
```

It prints a space. The JMP instruction goes to a subroutine that will return directly to the routine that called \$2011. Let's look again as a program calls the routine at \$200E.

```
200E A9 2A LDA #$2A ;asterisk
                                character
2010 2C A9 20 BIT $20A9 ;no
                                character
2013 4C D2 FF JMP $FFD2 ;CHROUT
                                routine
```

The BIT instruction does nothing; it changes no registers, and the status bits will not be used. Address \$20A9 is meaningless; there's really nothing of interest there. But note how that BIT opcode, \$2C, has managed to hide the instruction A9 20, which is located at address \$2011. This trick is used quite often in Commodore ROM code.

Let's put the above code into a BASIC driver and see it in action.

```
100 DATA 162,0,32,14,32,32,17,32,232,224,
10208
110 DATA 245,96,169,42,44,169,32,76,210,255
120 FOR J=8192 TO 8213
130 READ X:T=T+X
140 POKE J,X:NEXT
150 IF T<>2333 THEN STOP
160 SYS 8192
```

The program prints a line of spaces and asterisks. Disassemble it and see how BIT works. □

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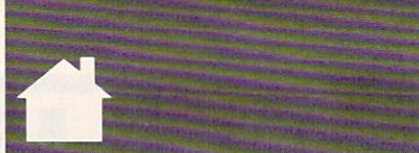
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Have you ever noticed how computers, keyboards, cameras, car phones, and CDs keep getting smaller? And how different devices are coming together—VCRs and cameras, CD players and boom boxes, computers and fax machines? Welcome to desktop fusion!

We are in an age of rampant miniaturization of everything electronic. For example, IBM scientists recently published a photo showing how they had lined up xenon atoms on a nickel surface to spell the company's name. Scientists hope that one day they'll be able to build ultrasmall computers that are just a few atoms wide.

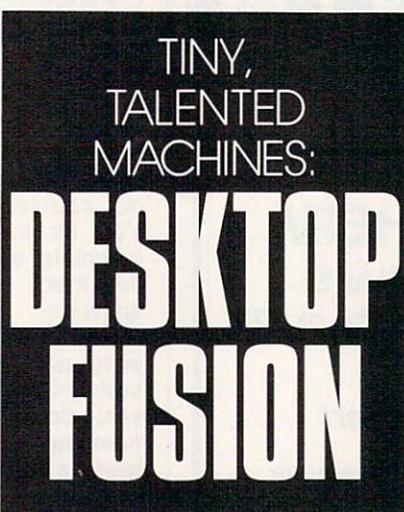
The process of miniaturization extends into the world of mechanical engineering as well. A new generation of *nanotechnologists* are attempting to shrink gears, electric motors, and pumps to microscopic size. They've achieved some remarkable successes.

Since more components can be squeezed into a smaller space, engineers could have let old machines continue to get smaller. Instead, they've begun combining older machines into new multifunction fusion machines that use the same space as older, single-purpose machines. But the fusion machines can do many more things and cost less than the combined price of the older machines. In fact, these new machines may be an entirely new species!

Take a look at computers. I bought one of the first Compaq portable computers years ago because I had to go to England to teach a summer-long course on robotics. Compaq called its machine a portable, but it was more like an old-fashioned, cast-iron sewing machine. By the time I had packed the portable into its case and strapped it around one shoulder and the portable Epson printer around the other shoulder, I resembled a guide on an expedition to climb Mount Everest. I had to walk slowly and stand perfectly straight. I didn't dare lean to one side for fear that I'd topple over and risk getting crushed by one of my "portable" machines.

Now companies are making computers many times more powerful than my old Compaq, and these machines weigh only a sixth as much. Some even fit into your pocket.

Take video cameras. Back in the 1970s along came the porta-pack—a camera and a VCR all in two boxes that you could carry on your shoulders. This was supposedly the dawn of the portable-video era. But the problem was that the porta-pack cameras were even heavier than my Compaq. Only big, husky people could become video whizzes in the early years.



Then the Japanese got into the act. Now the new Sony and JVC cameras combine the quality and functionality of a broadcast studio in a package the size of a kitten.

I once dreamed of my computer being like the sun, and I saw a constellation of other devices—video cameras, keyboards, CDs, VCRs, TVs, fax machines, telephones—swirling around the computer. In my dream, the devices came closer and closer until there was a blinding explosion.

The computer had swallowed all the other machines. It could now do what all the other machines did. It could take pictures and make phone calls. It could make copies and send faxes. It could record TV programs

and play stereo music.

But if it could do all these things, maybe it was no longer a computer. Maybe it was something more. If so, what was it? A Smart TV? A Teleputer? A MusiCopeiCalcutron?

We've all seen those computer screens that supposedly represent the ideal graphic environment of the future. You know, the ones with little pictures of file folders, stacks of electronic paper, and cute little trash cans.

The metaphor for computers of the future is supposed to be the desktop. We are told this makes computers user-friendly. Noncomputer types are more comfortable and less anxious. Their computer screen looks like a tiny copy of the office with its filing cabinets, folders, and trash cans.

This is all very cute. And it does make computers more understandable. But it may also be inaccurate. It may be preparing us for a world of the past, not the future. The new fusion machines do not have to sit on a desktop. They are so portable they can be carried anywhere.

Already, the computer is not necessarily the machine that sits on a desktop. Camcorders are really highly sophisticated video computers. Musical keyboards are incredibly complicated audio computers. Portable scanners, modems, cellular telephones, CD players, and TVs are all computers, too.

As fusion machines get smaller, they blast off from the desktop and soar like tiny spacecraft into the rest of our lives. We're carrying them in our pockets, briefcases, and purses. We wear them in our ears, hang them on our shoulders. They're merging with cosmetic jewelry and becoming part of people's lifestyles. They are colored in pastels and stripes and are enveloped in fabrics such as denim and corduroy—like designer clothes.

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BEGINNER BASIC

L A R R Y C O T T O N

Sprites are colorful shapes that are easily defined and controlled from BASIC on the 64 and 128. They can pop up anywhere on the screen and often manifest themselves in games as spaceships, aliens, or the like.

Sprites can be set up and manipulated independently of other items on the screen, such as text or character graphics (the figures on the front of the computer keys). In fact, they work very nicely with these, as illustrated by this month's exercise.

This month, I'll show you how straightforward programming sprites can be. We'll begin writing a short program which uses only one sprite, bearing in mind that the same techniques can be applied to display as many as eight sprites on the screen at once. Although this program isn't a game per se, you'll immediately see how to expand on your ability to program sprites in games or in other programs by using the simple BASIC commands that we've learned over the last few months. So, let's begin.

In addition to sprites, our program uses the 64's musical capabilities. We covered music in the July and August 1989 issues (also in the November and December issues), so you may want to refresh your memory by reviewing these columns.

We begin the program by clearing the sound (SID) chip's internal memory registers.

```
10 S=54272:FOR T=S TO S+24:POKE
T,0:NEXT
```

Next, we'll set up the SID chip's

square wave and musical envelope (attack, decay, sustain, and release) for voice 1, and turn up the volume to the maximum setting.

```
20 POKE S+3,8:POKE S+5,12:POKE
S+6,29:POKE S+24,15
```

Now, we'll clear the screen, color it and the border white, and draw a black musical treble-clef staff.

```
30 PRINT CHR$(147)CHR$(144):PO
KE 53280,1:POKE 53281,1
40 FOR T=1 TO 8:PRINT "
{18 SPACES}{3 @}":NEXT
```

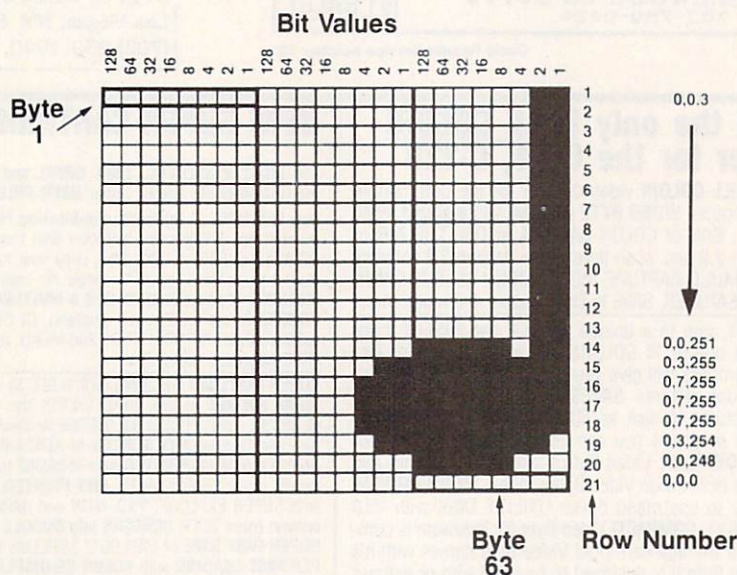
a group of 39 or so that begin at location 53248. When you program sprites, always start by defining that first memory register. The *Programmer's Reference Guide* calls it variable V, so we'll stick with that.

```
100 V=53248
```

Next, we'll define another variable, N, which will ultimately represent the vertical position of the sprite on the screen.

```
110 N=125
```

MUSICAL NOTE ON A SPRITE GRID



As you may recall, the 64's screen is composed of 64,000 individually addressable dots—called *pixels*—in a 320 × 200 (horizontal × vertical) matrix. The sprite can be located anywhere on the screen, although those near the borders may make the sprite invisible. The value 125 is the number of pixels the sprite will be offset from the top of the screen. We'll locate it horizontally in a moment.

Now comes the only tricky part, so pay close attention. We must define the

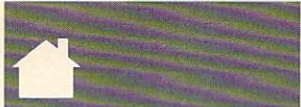
shape of the sprite, which in this program will be the symbol for a musical quarter note, which you can move up and down on the musical staff with the joystick. Naturally, appropriate sounds will emanate from your computer, corresponding to the position of the note on the staff. In other words, you'll be able to play a tune with the joystick.

Our ultimate goal is to generate 63 pieces of data that represent the sprite's shape, which we can POKE into certain memory registers in the computer. To create this data, it's

```
50 PRINT "{2 @}UI{35 @}
60 PRINT "{2 @}BB{35 @}
70 PRINT "{@}U+K{35 @}
80 PRINT "{@}B+I{35 @}
90 PRINT "{@}J+K{35 @}
92 PRINT " JK{15 SPACES}{3 @}
94 FOR T=1 TO 7:PRINT "
{18 SPACES}{3 @}":NEXT
```

The program may be run at this point, so try it. The staff, which is composed of some graphics characters, will form the background for our sprite, which we'll create next.

Sprites are controlled by 12 non-consecutive memory registers, within



BEGINNER BASIC

helpful to draw a grid such as the one shown in the accompanying figure. Then you must fill in the blocks according to the shape you want displayed on the screen. Last, add up the numbers above the blocks in the grid. Sound difficult? It's not.

Think of the grid as 21 rows of 24 tiny squares. Each row is divided into three groups of eight squares. Each group of eight squares represents one POKEable value (a byte). The first row, then, contains the first three bytes of the 63 pieces of data we need. The bytes in the grid are numbered as follows:

1	2	3
4	5	6

and so on, for 21 rows (21 rows times 3 bytes per row equals 63 bytes).

Note that the top of the grid is numbered, representing the corresponding bit value within each respective byte. Wherever a black square appears, the number above it—or bit value—should be added within that byte. For instance, bytes 1 and 2 are 0; no squares are blackened. Byte 3 contains only two blackened squares, under the numbers 1 and 2. Adding 1 and 2 yields 3, which, coincidentally, is the third piece of data for the sprite. In fact, for this sprite, the first 13 rows of the grid contain the numbers 0, 0, and 3. The maximum value a byte can hold, remember, is 255—the sum of 128, 64, 32, 16, 8, 4, 2, and 1. So, we READ and POKE the byte values in the sprite grid, as shown below.

```
120 FOR J=12288 TO 12350:READ
D:POKE J,D:NEXT
```

```
130 DATA 0,0,3,0,0,3,0,0,3,0,0,3,0,0,3,
0,0,3,0,0,3,0,0,3,0,0,3,0,0,3
```

```
140 DATA 0,0,3,0,0,251,0,3,255,0,7,255,0,7,
255,0,7,255,0,3,254,0,0,248,0,0,0
```

It has become customary to put the data for sprite 1 in memory locations 12288–12350, so we'll use them. If you're using less than four sprites, you might want to use locations 832–894 for sprite 1. Later, we'll tell the computer where to find the data.

We'll program the various sprite memory registers in a slightly different order from that used in the *Programmer's Reference Guide*. While the order isn't critical, it's more logical to assign the color and other parame-

ters before turning on the sprite.

First, we'll select the color for the sprite. Any color will do, so let's make it green. The color value for green is POKEd into register 53287 (use V+39 since we defined register 53248 as V in line 100).

150 POKE V+39,5

Next, we'll tell the computer where to look for the sprite data.

160 POKE 2040,192

If you put the data at 832–894, you'd POKE 2040,13 instead. The *Programmer's Reference Guide* goes into some detail about how to calculate this pointer value (13); we'll discuss it some more in a forthcoming column.

Memory register 53248 (V) happens to control the horizontal position of the sprite on the screen. We want it precisely 160 pixels from the left edge.

170 POKE V,160

Then we locate it vertically, using register 53249 and N, which was defined in line 110.

180 POKE V+1,N

Last but not least, we turn on the sprite using V+21. POKEing a 1 into this location turns on sprite 1.

190 POKE V+21,1

If you've been entering the program line by line, you're about to be rewarded. Run the program. If you haven't made any typing errors, the sprite, in the shape of a green quarter note, should now pop onto the screen, superimposed on a musical staff. Its position on the staff, the second space from the top, corresponds to a piano's C above middle C. At this point, be sure to save what you've typed in. In the next issue, we'll continue with this program and add some more features.

Next month, we'll move the note around with the joystick and play the notes which correspond to the sprite's position on the staff as we move it. We'll also go into more depth on positioning sprites, creating multiple sprites, and moving sprites at various speeds.

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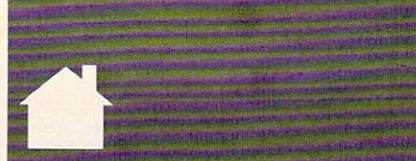
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PROGRAMMER'S PAGE

R A N D Y T H O M P S O N

This month you'll find some special effects, a joystick routine, and corrections for two previous programs.

Screen Fader

The following program fades out all of the text on the screen. Because the program relies on the computer's operating system to fill color memory, this routine will not work on some older 64s.

```
XS 10 POKE 53280,0:POKE 53281,
    0:POKE 646,1:POKE 648,24
    0
HX 20 FOR A=1 TO 6:READ C:POKE
    646,C:PRINT CHR$(147):N
    EXT
KM 30 POKE 648,4:POKE 646,1:PR
    INT CHR$(147)
CR 40 DATA 1,7,15,12,11,0
```

The color sequence used to fade the characters can be changed by altering the data in line 40. Each value (0-15) corresponds to one of the standard Commodore colors.

You may also change line 20 so that it reads the color values from memory instead of from DATA statements. For example, replace line 20's READ C:POKE 646,C instructions with POKE 646,PEEK(828+A), and the fade colors will be obtained from memory starting at location 828. This way, you don't have to use RESTORE before calling this routine for the second or third time.

CLINT KAWASAKI
ALTUS, OK

Earthquake

This short routine makes all of the characters on the screen shake back and forth.

```
ED 10 PRINT CHR$(147)TAB(14)"
    {DOWN}S H A K E!"
PH 20 FOR X=1 TO 10:FOR I=0 TO
    5:POKE 53270,(PEEK(5327
    0)AND248)+I:NEXT
QJ 30 POKE 53270,200:NEXT
```

You can use this code to produce explosion or earthquake effects.

JOHN SVOBODA
SWARTZ CREEK, MI

Improved 64 Joystick Handling

When I first started programming on the 64, I was irritated by the fact that using a joystick could scramble the keyboard and vice versa. So, I've devised a way to get around this problem.

The following BASIC program creates a short machine language subroutine that returns the value of a joystick in either port while filtering out

READERS' TIPS ON QUAKES, FADERS, SPOOLERS AND MORE

any interference with the keyboard.

After running this program, you can read a joystick by issuing the command *joy=USR(port)*, where *port* is the desired joystick port (1 or 2) and the current value of that port is returned in the *joy* variable. This subroutine automatically inverts port bits 0-3 so that it returns the values recommended on page 344 of the *Commodore 64 Programmer's Reference Guide*. That is, the value of *joy* AND 15 equals 0 if there's no joystick movement, 1 for up, 2 for down, 4 for left, 5 for up and left, 6 for down and left, 8 for right, 9 for up and right, and 10 for down and right. If *joy* AND 16 equals 0, the fire button is being pressed.

```
MX 100 JJ=49152:JH=INT(JJ/256)
    :JL=JJ-JH*256:POKE 785,
    JL:POKE 786,JH
MQ 110 FOR K=JJ TO JJ+67:READ
    {SPACE}Y:POKE K,Y:NEXT
SR 120 DATA 120,70,97,176,21,1
    69,127,141
AX 130 DATA 0,220,173,1,220,20
    1,255,240
BH 140 DATA 4,169,31,208,13,17
    3,0,220
EC 150 DATA 16,8,169,255,141,0
    ,220,173
MD 160 DATA 1,220,41,31,73,15,
    208,4
MK 170 DATA 133,97,240,23,133,
    98,169,136
QB 180 DATA 133,97,169,0,133,9
    9,133,100
XA 190 DATA 133,101,133,102,19
    8,97,6,98
SH 200 DATA 16,250,88,96
```

This program stores the joystick routine's machine language in memory at 49152. If this address is inconvenient, change the value assigned to JJ in line 100.

TIM MACINTA
FLINTSTONE, MD

Printer Spooler

Ted Grondski wrote to point out an error in his printer spooler program that was published in June's column. Line 180 should be changed to read

```
180 POKE A+219,H:POKE
    A+78,H+1
```

This correction is necessary if you wish to change the program's starting address.

Alpha Lock

Rev. Kenneth Cherry of Spring Grove, Pennsylvania, found an error in my May *Alpha Lock* program. The first value in line 300 should be a 20, not a 13. Without this change, the DEL key thinks it's a RETURN key whenever the alpha lock is activated.

"The Programmer's Page" is interested in your programming tips and tricks. Send all submissions to The Programmer's Page, *COMPUTE's Gazette*, P.O. Box 5406, Greensboro, North Carolina 27403. We'll pay \$25-\$50 for each tip we publish. □



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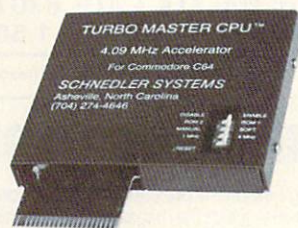
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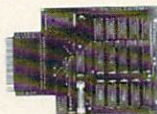
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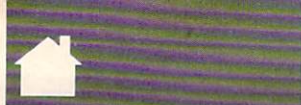
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AUTO PROOFREADER

P H I L I P I . N E L S O N

The Automatic Proofreader helps you type in program listings for the 128 and 64 and prevents nearly every kind of typing mistake.

Type in the *Proofreader* exactly as listed. Because the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unusual commands. After you've finished, save a copy before running it.

Next, type RUN and press Return. When the program displays the message *Proofreader Active*, you're ready to type in a BASIC program.

Every time you finish typing a line and press Return, the *Proofreader* displays a two-letter checksum in the upper left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the let-

ters match, it's almost certain the line was typed correctly. If not, check for your mistake and correct the line.

The *Proofreader* ignores spaces not enclosed in quotation marks, so you can omit or add spaces between keywords and still see a matching checksum. However, spaces inside quotes are significant, so the program pays attention to them.

The *Proofreader* does not accept keyword abbreviations (for example, ? instead of PRINT). If you use abbreviations, you can check the line later by LISTING it, moving the cursor back to the line, and pressing Return.

If you're using the *Proofreader* on the 128, do not perform any GRAPHIC commands while the *Proofreader* is active. When you perform a command like GRAPHIC 1, the computer moves everything at the start of

BASIC program space—including the *Proofreader*—to another memory area, causing it to crash. The same thing happens if you run any program with a GRAPHIC command while the *Proofreader* is in memory.

Though the *Proofreader* doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (65341 for the 128, 64738 for the 64). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

When using the *Proofreader* with another utility, disable both programs before running a BASIC program. □
see program listing on page 39

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ONLY ON DISK

There's something new on the *Gazette Disk!* In addition to the type-in programs found in each issue of the magazine, we're putting more features and programs each month on the *Gazette Disk*. Check out the original 64 and 128 artwork on display in "Gazette Gallery," and look for our bonus programs as well. These programs and their instructions appear only on disk. Here are descriptions of this month's bonus programs.

geoGammon

Douglas S. Curtis

Take on the computer in this modern game of strategy and chance for GEOS and GEOS 128, versions 1.3 and higher. This beautiful one-player version of backgammon will challenge your board skills for hours.

64-Shell

Bill Chin

Add a personal touch to your 64 with this slick interrupt-driven, pull-down menu utility. You can create custom menus that launch your favorite programs or issue DOS commands. These menus also work with other programs, like *MetaBasic*.

Multi-Color Lister

Robert Cook

This handy utility adds eye-catching color to your BASIC listings. It modifies BASIC's LIST routine to make individual elements of your program distinguishable. BASIC keywords, variables, and character strings are each displayed in a unique color, making your editing and debugging work easier.



PROGRAMS

M A R I U S Z J A K U B O W S K I

The year is 2141 A.D. Ravaged by pollution, the planet Earth is now all but uninhabitable. For the past 50 years, scientists have desperately scoured the heavens for another planet to colonize. So far, they've had little success—until now. In a miraculous turn of events, a suitable planet has just been located in Section Pi. This oasis in the cosmic void is seen as man's last hope for survival.

After a careful survey of this planet, vestiges of a supreme alien culture are uncovered. Though the aliens were long ago destroyed by their own weapons, their robotic defense system remains intact and active. To make matters worse, this system is enclosed in eight tunnels below the surface of the planet. If our species is to survive, you must pilot a specially equipped fighter to the planet and destroy the robotic defense system.

Getting Started

Section Pi is written entirely in machine language. To type it in, you'll need *MLX*, a machine language entry program. See "Typing Aids" elsewhere in this section. The *MLX* prompts, and the values you should enter, are as follows:

Starting address: \$1D4D

Ending address: \$3284

When you've finished typing, be sure to save the program to disk.

To play a game, plug a joystick into port 2 and type *LOAD "filename"*, 8,1, where *filename* is the name you used when you saved the program. After the program has loaded, enter the command *SYS 7501*. When the title screen appears, press the fire button to begin play.

Playing the Game

The object of *Section Pi* is to blast your way through eight levels, or *stages*, of robotic attack. You begin the mission with four fighter craft. You must avoid or destroy the alien robot ships that you encounter, as well

as any debris that obstructs your path. Contact with either results in the loss of a ship. The game ends when you've lost all your fighters or you've completed the eighth stage.

The stage number, high score, and current score are displayed at the top of the screen. The number of ships remaining is shown below the stage number. For every 10,000 points you score, you're awarded an extra fighter. On the first stage, you receive 100 points for each robotic craft you de-

SECTION PI

GET OUT YOUR
PLASMA GUN AND
START BLASTING IN
THIS FAST-ACTION
ARCADE-STYLE
GAME FOR THE 64.
JOYSTICK REQUIRED.

stroy. With each successive stage, you earn 50 additional points per robot. Each piece of the tunnel you vaporize is worth 10 points. The *level guardians*, or oversized alien robots, that appear at the end of each stage are worth three times the current point value of the smaller robots.

The robots that are found deep in the tunnels are built to withstand greater pressure and more severe temperatures. As a result, these robots require more shots before they're destroyed. You'll notice that these deep-level robots move more quickly, too.

Words to Live By

There are several playing strategies you might like to try. When you come upon the level guardians, don't be discouraged. They'll attack your fighter in a chainlike formation that spans the entire width of a tunnel. To fly through them, destroy the robot on the outside of the formation first; then you can maneuver your craft through the remaining guardians.

At the higher stages, the robots require more hits to be destroyed. Again, to survive an attack, you must single out and destroy one robot in the formation and then fly through the vacated space.

When one of your ships has been destroyed, a new one will appear. For a brief moment, this ship is invincible. Be sure to use this time to take out as many robots as possible.

Section Pi

```
1D4D:A2 00 0E 0E DC 86 FB 86 0B
1D55:FD A9 D0 85 FC A9 38 85 EF
1D5D:FE A9 33 85 01 A2 08 A0 83
1D65:00 B1 FB 91 FD C8 D0 F9 53
1D6D:E6 FC E6 FE CA D0 F2 A9 50
1D75:37 85 01 A9 1E 8D 18 D0 8F
1D7D:4C 37 1E A9 FB CD 12 D0 16
1D85:10 FB A6 02 CA 10 02 A2 F8
1D8D:07 86 02 AD 16 D0 29 F7 46
1D95:09 10 05 02 8D BC 2F E0 B7
1D9D:07 F0 03 4C E5 1D A2 0D B2
1DA5:A9 04 8D BB 1D 8D BE 1D DC
1DAD:A9 51 8D BA 1D A9 50 8D 2C
1DB5:BD 1D A0 00 B9 51 04 99 DE
1DBD:50 04 C8 C0 27 90 F5 18 C5
1DC5:AD BA 1D 7D 4F 2D 8D BA 06
1DCD:1D 8D BD 1D AD BB 1D 69 83
1DD5:00 8D BB 1D 8D BE 1D CE 2D
1DDD:BD 1D CA 10 D5 20 D3 2C 9B
1DE5:A9 FB CD 12 D0 30 FB 60 6E
1DED:AD 12 D0 C9 FB D0 F9 60 B1
1DF5:A9 01 8D 19 D0 A2 FB AC 3E
1DFD:BC 2F AD 12 D0 C9 FB 90 6F
1E05:15 A2 07 20 65 2B CA 10 D4
1E0D:FA AD 1F D0 8D E5 2F 20 A5
1E15:5D 2D A2 42 A0 C8 8E 12 1B
1E1D:D0 8C 16 D0 20 6A 2C D0 D7
1E25:5C 2B AD 0D DC 29 01 F0 5F
1E2D:06 20 47 2A 20 6B 25 4C 45
1E35:BC FE 20 45 20 20 EF 22 6B
1E3D:A2 2E BD DC 2D 9D 00 D0 8C
1E45:CA 10 F7 A9 0B 8D 86 02 22
1E4D:A9 93 20 D2 FF A2 18 BD EC
1E55:13 2E 9D 00 D4 CA 10 F7 44
1E5D:E8 86 02 A9 7F 8D 0D DC B3
1E65:A9 F5 8D 14 03 A9 1D 8D 6D
1E6D:15 03 A2 5F BD 7C 2D 9D 17
1E75:F8 38 CA 10 F7 A9 28 20 6D
```




PROGRAMS

1E7D:0F	23	A2	07	BD	0B	2E	9D	E2	20DD:50	55	54	45	21	00	1F	50	12	233D:23	AD	EB	2F	F0	06	A9	04	E7
1E85:F8	07	CA	10	F7	A9	81	8D	51	20E5:52	45	53	53	20	46	49	52	3F	2345:A8	20	4A	23	60	8D	C6	23	4D
1E8D:0E	DC	8D	1A	D0	A2	00	BD	2A	20ED:45	20	54	4F	20	53	54	41	90	234D:A9	08	8D	C7	23	A2	06	38	80
1E95:4C	2E	C9	FF	F0	06	20	D2	6F	20F5:52	54	00	0D	03	0E	06	00	A1	2355:BD	01	D0	F9	01	D0	B0	06	27
1E9D:FF	E8	D0	F3	20	CB	24	CE	B4	20FD:00	00	00	06	0E	03	0D	B9	235D:C9	EA	B0	11	90	04	C9	16	A8	
1EA5:C6	2F	AD	B4	2F	C9	09	B0	75	2105:00	78	F8	18	AD	C4	2F	69	4E	2365:90	0B	0E	C7	23	E8	E8	E0	64
1EAD:48	20	80	1D	AD	00	DC	29	48	210D:50	8D	C4	2F	AD	C5	2F	69	B2	236D:0F	90	E4	18	60	AD	C7	23	E9
1EB5:10	D0	03	20	D2	2B	20	33	47	2115:00	8D	C5	2F	D8	A9	0E	8D	7D	2375:2D	B6	2F	F0	49	A9	00	8D	73
1EBD:23	20	F7	24	20	33	25	20	0D	211D:27	D0	A9	81	8D	04	D4	8D	28	237D:C9	23	8D	C8	23	AD	C7	23	32
1EC5:4D	22	90	03	4C	01	20	AD	C7	2125:0B	D4	A9	78	8D	CF	2F	A0	89	2385:2D	10	D0	F0	03	EE	C9	23	1A
1ECD:E5	2F	48	29	02	F0	05	A9	EB	212D:00	A9	C8	8D	16	D0	20	ED	ED	238D:AD	C6	23	2D	10	D0	F0	03	3C
1ED5:01	20	7A	2A	68	29	04	F0	6D	2135:1D	98	20	2A	25	20	21	23	E1	2395:EE	C8	23	38	BD	00	D0	F9	F6
1EDD:05	A9	02	20	7A	2A	AD	C2	E3	213D:4D	22	D0	A8	CE	CB	2F	CE	26	239D:00	D0	8D	CA	23	AD	C9	23	FC
1EE5:2F	0F	BF	20	7A	2A	20	A3	38	2145:CB	2F	AD	CE	2F	8D	01	D4	32	23A5:ED	C8	23	B0	10	38	B9	00	59
1EED:24	A9	00	8D	C2	2F	4C	A7	92	214D:8D	08	D4	CE	CF	2F	D0	ED	9B	23AD:D0	FD	00	D0	8D	CA	23	AD	74
1EF5:1E	78	20	81	FF	20	8A	FF	11	2155:A9	20	20	0F	23	A9	80	8D	B7	23B5:C8	23	ED	C9	23	D0	07	AD	9B
1EFD:A9	C2	A2	07	9D	F8	07	CA	2E	215D:04	D4	8D	0B	D4	A9	07	8D	22	23BD:CA	23	C9	19	90	08	4C	67	A1
1F05:10	FA	A9	00	A2	10	9D	00	CF	2165:15	D0	A9	0E	20	21	23	AD	F5	23C5:23	00	00	00	00	00	C0	00	1F
1F0D:D0	CA	10	FA	A9	34	A2	0E	89	216D:B4	2F	09	30	8D	B9	21	A9	39	23CD:D0	02	38	60	A9	00	C0	02	DA
1F15:9D	01	D0	18	69	19	CA	CA	0E	2175:B4	8D	B8	2F	EE	B4	2F	AD	D5	23D5:D0	03	8D	EA	2F	C0	04	D0	FA
1F1D:10	F6	A2	FF	8E	15	D0	8E	6E	217D:B4	2F	C9	09	02	58	60	4D	23DD:03	8D	EB	2F	8A	4A	AA	18	64	
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1F2D:D0	8E	1D	D0	8E	21	D0	8E	51	218D:47	05	E8	E0	1B	90	F3	A2	85	23ED:9D	27	D0	A9	00	9D	EE	2F	05
1F35:20	D0	8E	00	20	8E	18	D4	C9	2195:00	BD	C9	21	29	BF	9D	EF	06	23F5:A9	04	9D	DC	2F	A9	C9	9D	E4
1F3D:A2	09	BD	BF	1F	9D	25	D0	4D	219D:05	E8	E0	0A	90	F3	20	D3	C1	23FD:F8	07	AD	BC	2F	AD	C7	23	05
1F45:CA	10	F7	A9	93	20	D2	FF	49	21A5:21	20	DB	21	EE	07	04	58	02	2405:8D	B6	2F	A9	00	8D	CC	2F	41
1F4D:A2	07	A0	0C	18	20	F0	FF	96	21AD:60	53	20	54	20	41	20	47	CB	240D:A9	81	8D	0B	D4	B0	1A	AD	38
1F55:A9	85	A0	1F	20	1E	AB	A2	43	21B5:20	45	20	20	31	20	20	43	EC	2415:C4	2F	8D	D9	2F	AD	C5	2F	C5
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1F65:97	A0	1F	20	1E	AB	78	AD	BB	21C5:20	45	20	44	47	4F	4F	44	0C	2425:D0	F0	06	20	40	24	20	40	E7
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1F75:1F	AD	00	DC	29	10	D0	EF	97	21D5:DC	29	10	D0	F9	60	A9	00	84	2435:21	8D	0B	D4	A9	05	8D	CC	69
1F7D:AD	00	20	F0	EA	4C	01	20	50	21DD:8D	17	D0	8D	1D	D0	A2	07	18	243D:2F	D0	EE	78	F8	18	AD	E9	24
1F85:99	43	4F	4E	47	52	41	54	8A	21E5:9D	DC	2F	9D	EE	2F	CA	10	C7	2445:2F	6D	D9	2F	8D	E9	2F	8D	AE
1F8D:55	4C	41	54	49	4F	4E	53	6E	21ED:F7	20	42	22	8D	22	D0	20	55	244D:C2	2F	AD	E8	2F	6D	DA	2F	1B
1F95:21	00	1E	41	4C	4C	20	53	63	21F5:42	22	8D	23	D0	20	42	22	73	2455:8D	E8	2F	08	AD	E7	2F	69	D9
1F9D:45	43	54	4F	52	53	20	43	32	21FD:20	21	23	D0	42	22	8D	C3	78	245D:00	8D	E7	2F	28	90	13	AE	51
1FA5:4C	45	41	52	45	44	20	2D	51	2205:2F	20	2A	25	20	42	22	8D	5C	2465:B9	2F	DE	29	04	EE	B9	2F	43
1FAD:20	4D	49	53	53	49	4F	4E	5A	220D:C0	2F	20	0F	23	20	42	22	B2	246D:A9	00	8D	CC	2F	A9	41	8D	39
1FB5:20	43	4F	4D	50	4C	45	54	26	2215:8D	6B	2D	8D	76	2D	20	42	64	2475:0B	D4	D8	58	60	A0	00	8C	2B
1FBD:45	00	03	06	08	04	0A	0E	D1	221D:22	8D	BE	2F	8D	BF	2F	20	8A	247D:EC	2F	B9	E7	2F	20	8B	24	F2
1FCS:04	08	0A	0E	AD	12	D0	C9	4B	2225:42	22	A2	04	9D	FE	07	CA	5D	2485:C8	C0	03	90	F5	60	48	4A	D7
1FCD:FA	D0	F9	A2	00	A0	07	B9	71	222D:10	FA	8D	B5	2F	AE	BB	2F	20	248D:4A	4A	4A	20	96	24	68	29	18
1FDD:58	1F	48	8A	48	98	A2	01	F4	2235:E8	8E	BB	2F	8E	C1	2F	A9	7F	2495:0F	18	69	30	AE	EC	2F	9D	C0
1FDD:20	CA	29	68	AA	68	38	E9	DB	223D:78	8D	F7	2F	60	AC	E4	2F	C1	249D:21	04	EE	EC	2F	60	AD	C6	41
1FE5:01	D0	EF	E8	E8	88	10	E7	D6	2245:B9	79	2F	C8	0C	E4	2F	60	ED	24A5:2F	D0	18	38	AD	B3	2F	ED	C8
1FED:AD	00	D0	C9	64	90	03	EE	14	224D:AD	B8	2F	08	0D	CE	B8	2F	CF	24AD:E9	2F	AD	B2	2F	ED	E8	2F	C9
1FF5:00	20	60	01	02	03	01	02	78	2255:AD	27	D0	49	0E	8D	27	D0	AE	24B5:AD	B1	2F	ED	E7	2F	B0	39	9C
1FFD:01	03	01	00	78	20	81	FF	E4	225D:18	60	A9	0E	8D	27	D0	A9	30	24BD:EE	C6	2F	A2	02	BD	E7	2F	45
2005:20	8A	FF	A9	00	8D	20	D0	D9	2265:F0	8D	5E	23	A9	10	8D	64	90	24C5:9D	B1	2F	CA	10	F7	A9	12	A1
200D:8D	21	D0	A2	0A	A0	0F	18	A9	226D:23	A9	14	8D	C0	23	A9	01	EF	24CD:8D	9D	24	A9	04	8D	9E	24	1B
2015:20	F0	FF	A9	39	A0	20	20	E8	2275:A0	00	20	4A	23	A9	EA	8D	D5	24D5:A9	B1	8D	80	24	A9	2F	8D	CC
201D:1E	AB	20	25	20	4C	37	1E	6C	227D:5E	23	A9	16	8D	64	23	A9	3E	24DD:81	24	20	7A	24	A9	21	8D	33
2025:A0	8C	AD	12	D0	C9	33	D0	94	2285:19	8D	C0	23	B0	09	AD	E5	EE	24E5:9D	24	A9	04	8D	9E	24	A9	54
202D:F9	AD	12	00	C9	32	D0	F9	D7	228D:2F	29	01	D0	02	18	60	78	8A	24ED:E7	8D	80	24	A9	2F	8D	81	86
2035:88	D0	EF	60	9A	92	47	41	E0	2295:A9	81	8D	04	D4	8D	0B	D4	C8	24F5:24	60	A2	03	BD	EE	2F	F0	E5
203D:4D	45	20	4F	56	45	52	00	DA	229D:A9	B4	8D	B8	2F	A2	00	20	45	24FD:26	DE	EE	2F	D0	09	AD	C3	AB
2045:20	81	FF	20	8A	FF	A9	28	C7	22A5:ED	1D	EE	27	D0	CA	D0	F7	C3	2505:2F	9D	27	D0	4C	24	25	BD	3B
204D:8D	FA	2F	A2	00	A0	0B	18	1C	22AD:A9	80	8D	04	D4	8D	0B	D4	A0	250D:27	D0	29	0F	CD	C3	2F	F0	02
2055:20	F0	FF	A9	BD	A0	20	20	4D	22B5:CE	B9	2F	AE	B9	2F	30	30	BB	2515:09	AD	C3	2F	9D	27	D0	4C	32
205D:1E	AB	A2	0B	A0	0C	18	20	22	22BD:FE	29	04	A9	0E	8D	27	D0	AC	251D:24	25	A9	01	9D	27	D0	E8	1C
2065:F0	FF	A9	D1	A0	20	20	1E	54	22C5:A2	01	A0	96	8E	00	D0	8C	BB</									



PROGRAMS

259D:2F	BD	9B	2E	8D	CB	25	AD	D8	27FD:1B	D4	8D	6B	28	8D	6C	28	EF	2A5D:8D	04	D4	AE	CC	2F	E0	3C	20
25A5:CB	25	F0	13	C9	01	F0	12	B4	2805:A9	08	8D	EB	27	A2	06	A0	0D	2A65:B0	12	E8	E8	E8	8E	CC	2F	8C
25AD:C9	02	F0	11	C9	03	F0	10	D8	280D:03	8A	48	20	C7	28	98	A2	3F	2A6D:8E	08	D4	E0	3C	90	05	A9	8B
25B5:C9	04	F0	0F	4C	06	21	4C	FD	2815:FF	20	CA	29	20	CA	29	20	F7	2A75:80	8D	0B	D4	60	48	A9	81	15
25BD:69	26	4C	FF	26	4C	EE	27	37	281D:CA	29	AD	6B	28	2D	EB	27	7E	2A7D:8D	0B	D4	A9	28	8D	CC	2F	D0
25C5:4C	6D	28	4C	F3	28	00	A2	3E	2825:D0	04	98	20	CA	29	68	AA	6A	2A85:A9	00	8D	C9	2F	AE	02	D0	06
25CD:06	AD	1B	D4	C9	40	B0	04	EB	282D:AD	6C	28	2D	EB	27	D0	15	F9	2A8D:AC	03	D0	AD	10	D0	29	02	06
25D5:A0	00	F0	12	C9	80	B0	04	65	2835:DE	01	D0	BD	01	D0	C9	46	50	2A95:F0	05	A9	01	8D	C9	2F	68	43
25DD:A0	0B	D0	0A	C9	C0	B0	04	AC	283D:B0	21	AD	6C	28	0D	EB	27	1F	2A9D:48	C9	01	F0	17	A9	00	8D	A4
25E5:A0	16	D0	02	A0	21	AD	1B	40	2845:8D	6C	28	0D	16	FE	01	D0	09	2AA5:C9	2F	AE	04	D0	AC	05	D0	D4
25ED:D4	4A	4A	4A	18	79	0A	26	04	284D:BD	01	D0	C9	E4	90	0C	A9	9E	2AAD:AD	10	D0	29	04	F0	05	A9	21
25F5:9D	00	D0	C8	E8	E0	10	90	31	2855:FF	38	ED	EB	27	2D	6C	28	1F	2AB5:01	8D	C9	2F	8A	18	65	02	9B
25FD:ED	AD	10	D0	29	07	19	0A	5B	285D:8D	6C	28	0E	EB	27	E8	E8	2C	2ABD:01	8D	C9	2F	8A	18	65	02	9B
2605:26	8D	10	D0	60	00	3C	00	52	2865:C8	C0	08	90	A4	60	00	00	FA	2AC5:8D	C9	2F	AD	C8	2F	38	E9	71
260D:5F	00	82	00	A5	00	BE	00	04	286D:AD	B7	2F	D0	11	20	1B	2A	DE	2ACD:20	8D	C8	2F	AD	C9	2F	E9	7E
2615:32	3C	32	5F	32	82	32	A5	6B	2875:20	36	26	8D	B7	2F	AD	1B	F1	2AD5:00	4A	AD	C8	2F	6A	4A	01	01
261D:32	BE	F8	00	E6	46	E6	8C	FB	287D:D4	29	18	8D	6B	28	A9	08	B5	2ADD:8D	C8	2F	98	38	E9	2A	4A	A2
2625:E6	D2	E6	23	E6	80	00	3C	1E	2885:8D	EB	27	A2	06	A0	03	AD	0D	2AE5:4A	4A	8D	CA	2F	A9	00	85	F5
262D:00	E6	E6	E6	32	E6	32	3C	4C	288D:01	D0	D0	01	D0	90	06	FE	32	2AED:FB	A9	04	85	FC	AE	CA	2F	EA
2635:C0	A9	54	A2	06	9D	00	D0	78	2895:01	D0	4C	9D	28	DE	01	D0	8D	2AF5:18	A5	FB	69	28	85	FB	A5	CA
263D:AD	1B	D4	4A	4A	4A	7D	00	DC	289D:8A	48	20	C7	28	98	A2	FF	AE	2AFD:FC	69	00	85	FC	CA	D0	F0	29
2645:D0	E8	E8	E0	10	90	EE	AD	AD	28A5:2A	CA	29	20	CA	29	AD	6B	A1	2B05:18	A5	FB	6D	C8	2F	85	FB	31
264D:1B	D4	4A	4A	69	50	A2	06	22	28AD:28	2D	EB	27	F0	07	98	20	42	2B0D:A5	FC	69	00	85	FC	38	A5	D8
2655:9D	01	D0	69	1E	D0	E8	E0	A8	28B5:CA	29	20	CA	29	68	AA	0E	B4	2B15:FB	E9	29	85	FB	A5	FC	E9	BB
265D:10	90	F5	AD	10	D0	08	08	3E	28BD:EB	27	E8	E8	C8	C0	08	90	63	2BD1:00	85	FC	A0	00	A2	00	AD	B6
2665:8D	10	D0	60	AD	B7	2F	D0	18	28C5:C6	60	AD	EB	27	2D	B6	2F	90	2B25:C0	2F	91	FB	BD	54	2B	18	47
266D:00	20	CC	25	20	1B	2A	8D	81	28CD:F0	23	AD	10	D0	2D	EB	27	50	2B2D:65	FB	85	FB	A5	FC	69	00	99
2675:B7	2F	AD	E6	2F	F0	04	CE	A1	28D5:D0	1B	BD	00	D0	C9	20	B0	AB	2B35:85	FC	E8	E0	08	90	E8	A9	B6
267D:E6	2F	60	A9	08	8D	D0	2F	F6	28DD:14	98	AA	AD	C7	23	48	AD	97	2B3D:10	8D	D9	2F	8C	DA	2F	20	7B
2685:AD	B4	2F	AA	CA	BD	F7	26	C9	28E5:EB	27	8D	C7	23	38	20	EA	49	2B45:40	24	68	C9	01	D0	04	8C	4E
268D:0D	E6	2F	A2	00	A0	03	BD	B0	28ED:23	68	8D	C7	23	60	AD	B7	C5	2B4D:EA	2F	60	8C	EB	2F	60	01	97
2695:07	D0	CD	01	D0	F0	0B	B0	74	28F5:2F	D0	4A	AE	BA	2F	E8	E8	93	2B55:01	26	01	01	26	01	01	AD	CA
269D:06	FE	07	D0	4C	A7	26	DE	C6	28FD:EE	BA	2F	8E	C1	2F	A9	46	77	2B5D:C7	2F	F0	03	CE	C7	2F	60	06
26A5:07	D0	A9	00	8D	F5	26	8D	FC	2905:A2	06	9D	01	D0	A9	18	18	63	2B65:AD	EA	2F	D0	0A	AD	15	D0	42
26AD:F6	26	AD	10	D0	2D	00	2F	C1	290D:7D	01	D0	E8	E8	E0	10	90	82	2B6D:29	FD	8D	15	D0	D0	28	EE	E3
26B5:F0	05	A9	01	8D	F5	26	AD	3F	2915:F1	A9	96	A2	06	9D	00	D0	3F	2B75:02	D0	D0	08	AD	10	D0	09	F3
26BD:10	D0	29	01	F0	05	A9	01	6B	291D:A9	0A	18	7D	00	D0	E8	E8	9F	2B7D:02	8D	10	D0	AD	10	D0	29	BF
26C5:8D	F6	26	8A	48	38	BD	06	A8	2925:00	10	90	F1	AD	10	D0	09	75	2B85:02	F0	14	AD	02	D0	C9	50	AD
26CD:D0	ED	00	D0	AD	F5	26	ED	8A	292D:F8	8D	10	D0	A9	F8	8D	ED	A8	2B8D:90	0D	A9	00	8D	EA	2F	AD	C8
26D5:F6	26	B0	09	98	A2	01	20	3F	2935:27	8D	17	D0	8D	1D	D0	20	11	2B95:15	D0	29	FD	8D	15	D0	AD	BF
26DD:CA	29	4C	E8	26	98	A2	FF	CA	293D:1B	2A	8D	B7	2F	A9	08	8D	92	2B9D:EB	2F	D0	08	AD	15	D0	29	DC
26E5:20	CA	29	68	AA	0E	D0	2F	FE	2945:EB	27	A2	06	A0	03	AD	ED	66	2BA5:FB	8D	15	D0	EE	04	D0	D0	07
26ED:E8	E8	C8	E0	0A	90	A0	60	44	294D:27	2D	EB	27	D0	25	FE	01	88	2BAD:08	AD	10	D0	09	04	8D	10	06
26F5:00	00	03	02	02	02	01	01	DD	2955:D0	FE	01	D0	AD	B4	2F	C9	65	2BB5:D0	AD	10	D0	29	04	F0	14	3E
26FD:01	01	AD	B7	2F	D0	1E	20	55	295D:07	90	06	FE	01	D0	FE	01	52	2BBD:AD	04	D0	C9	50	90	0D	A9	2B
2705:CC	25	20	1B	2A	8D	B7	2F	DE	2965:D0	BD	01	D0	C9	D0	90	2E	9D	2BC5:00	8D	EB	2F	AD	15	D0	29	7C
270D:AD	1B	D4	8D	CB	27	8D	ED	79	296D:AD	ED	27	D0	E8	E8	27	8D	ED	2BCD:FB	8D	15	D0	60	AD	C7	2F	AD
2715:27	AE	B4	2F	E0	05	B0	02	AA	2975:27	D0	23	DE	01	D0	DE	01	EB	2BD5:F0	01	60	AC	01	D0	A2	01	4D
271D:29	38	8D	6B	28	A9	08	8D	FB	297D:D0	AD	B4	2F	C9	03	90	03	AB	2BDD:A9	00	8D	69	2C	AD	EA	2F	6E
2725:EB	27	A2	06	A0	03	AD	EB	40	2985:DE	01	D0	BD	01	D0	C9	46	A2	2BE5:D0	38	AD	10	D0	29	FD	D0	1E
272D:27	2D	EC	27	F0	34	8A	48	20	298D:80	0C	A9	FF	38	ED	EB	27	E8	2BED:10	D0	29	01	F0	03	8E	69	CF
2735:98	A2	01	20	CA	29	AD	EB	DC	2995:2D	ED	27	8D	ED	27	8A	48	21	2BF5:2C	18	AD	00	D0	69	0F	8D	F5
273D:27	2D	6B	28	F0	04	98	20	43	299D:AD	B4	2F	AA	CA	BD	C2	29	80	2BFD:02	D0	AD	69	2C	69	0F	F0	CD
2745:CA	29	68	AA	AD	10	D0	2D	77	29A5:AA	98	20	CA	29	AD	B4	2F	BC	2C05:08	AD	10	D0	09	02	8D	10	57
274D:EB	27	F0	13	BD	00	D0	C9	04	29AD:C9	07	90	04	98	20	CA	29	FC	2C0D:D0	8C	03	D0	AD	15	D0	09	CA
2755:36	90	0C	A9	FF	38	ED	EB	A7	29B5:68	AA	0E	EB	27	E8	E8	C8	DE	2C15:02	8D	15	D0	8D	EA	2F	4C	44
275D:27	2D	EC	27	8D	EC	27	4C	55	29BD:C0	08	90	8A	60	FF	01	FF	32	2C1D:59	2C	AD	EB	2F	D0	44	AD	94
2765:95	27	8A	48	98	A2	FF	20	8D	29C5:FF	01	FF	FF	FF	8C	CE	2F	57	2C25:10	D0	29	FB	8D	10	D0	29	16
276D:CA	29	AD	EB	27	2D	6B	28	CC	29CD:EE	CD	2F	8D	CF	2F	8A	A8	92	2C2D:01	F0	03	8E	69	2C	18	AD	65
2775:F0	04	98	20	CA	29	68	AA	C8	29D5:AD	CF	2F	8A	AA	C0	01	D0	A4	2C35:00	D0	69	0F	8D	04	D0	AD	AB
277D:AD	10	D0	2D	EB	27	D0	10	41	29DD:0E	FE	00	D0	D0	20	20	0D	58	2C3D:69	2C	69	00	F0	08	AD	10	95
2785:BD	00	D0	C9	21	B0	09	AD	F4	29E5:2A	4D	10	D0	8D	10	D0	C0	BE	2C45:D0	09	04	8D	10	D0	8C	05	83
278D:EC	27	0D	EB	27	8D	EC	27	EC	2																	



PROGRAMS

2C8D:C9 46 90 03 CE 01 D0 C0 AB	2F1D:02 02 02 02 02 02 02 03 7C	317D:FE C0 63 00 00 00 00 00 FB
2CC5:01 D0 0A AD 01 D0 C9 E6 B4	2F25:01 02 02 03 00 01 02 03 FF	3185:00 00 00 B0 00 00 C0 00 74
2CCD:B0 03 EE 01 D0 60 CE F7 CA	2F2D:03 01 01 01 04 02 05 02 B1	318D:80 00 02 B0 03 00 C0 38 4D
2CD5:2F D0 2C AD BE 2F CD C0 69	2F35:02 00 00 01 00 01 01 02 AC	3195:00 00 20 20 0F 30 38 24 CB
2CDD:2F F0 19 AD 1B D4 C9 A0 68	2F3D:02 02 02 03 01 00 00 02 97	319D:00 30 08 00 00 30 00 03 D0
2CE5:B0 12 AD C0 2F 8D BE 2F 39	2F45:02 02 03 00 00 01 01 04 8F	31A5:00 00 00 00 00 38 30 00 20 AA
2CED:AD 1B D4 4A 4A 69 28 8D F8	2F4D:05 00 01 02 01 04 02 02 8C	31AD:00 00 00 00 0C 00 0C 28 B0
2CF5:F7 2F D0 0B AD BF 2F 8D 39	2F55:02 02 02 04 05 00 02 00 E1	31B5:00 00 1B 00 00 0C 00 00 AB
2CFD:BE 2F A9 78 8D F7 2F A9 92	2F5D:01 02 02 02 02 02 00 04 39	31BD:00 00 63 00 00 00 0C 03 A7
2D05:04 8D 32 2D A9 77 8D 31 55	2F65:05 01 C3 07 00 B4 03 0A 52	31C5:00 30 0D 80 03 C3 C0 00 86
2D0D:2D A0 0D 18 B9 4F 2D 6D 1C	2F6D:02 D8 03 24 24 28 02 01 6C	31CD:F0 00 03 BC 30 00 F0 2C 64
2D15:31 2D 8D 31 2D A9 00 6D 95	2F75:0E 00 01 01 09 08 0F 0C 9D	31D5:30 00 D8 2C 38 EC D8 2E
2D1D:32 2D 8D 32 2D AE C0 2F 85	2F7D:29 48 25 C4 06 0C 0B 0E F7	31DD:30 AC E7 00 30 2F 30 0C 2B
2D25:AD 1B D4 D9 41 2D B0 03 78	2F85:2A 50 24 C1 0B 0E 0B 04 58	31E5:3C 2C C0 00 18 00 00 EC 37
2D2D:AE BE 2F 8E 77 04 18 88 E1	2F8D:28 40 22 C5 09 08 0F 0C 43	31ED:00 0C 00 30 3B 00 0C F7 40
2D35:10 D9 A2 22 8E 77 04 E8 C7	2F95:29 48 23 C3 06 0E 0B 0E C7	31F5:00 00 E6 80 00 3B 00 00 2A
2D3D:8E E7 07 60 FA FA C8 64 79	2F9D:20 50 24 C4 09 0A 0F 05 84	31FD:00 00 63 C0 0C 0C 00 3B A4
2D45:32 14 14 14 14 1E 3C 6E 81	2FA5:29 48 24 C5 09 08 0F 0C 1E	3205:00 03 07 C0 00 F2 00 00 E2
2D4D:D2 FA 28 28 28 28 28 28 B1	2FAD:2A 50 25 C2 01 74 50 01 81	320D:B0 F0 03 EC EC 30 0F 6B 88
2D55:A0 78 C8 28 28 28 28 28 14	2FB5:C3 07 00 B4 03 0A 02 D8 20	3215:EC E3 9C E7 0C F8 9A 6C E0
2D5D:CE BD 2F D0 19 A9 04 8D 86	2FBD:03 24 24 28 02 01 0E 00 DD	321D:0F E8 DB 00 3F 9B 2C 0C 8B
2D65:BD 2F A2 07 18 BD 40 39 A0	2FC5:01 01 00 00 00 00 00 3E 23	3225:EC EB 30 00 DC 00 03 2C 1A
2D6D:4A 08 4A 28 90 02 09 40 99	2FCD:00 00 00 00 00 00 00 2C	322D:00 3B F0 00 EA C0 30 3A 73
2D75:9D 40 39 CA 10 EE 60 7E FD	2FD5:00 00 00 00 00 00 00 34	3235:C0 0C E5 C0 00 36 00 00 1E
2D7D:30 18 7E 18 30 7E 00 00 C2	2FDD:00 00 00 00 00 00 00 3C	323D:0C 00 63 00 0C 03 30 3B 9C
2D85:00 00 00 00 00 00 00 0C EB	2FE5:00 00 00 00 00 00 00 44	3245:0C 30 DB C3 0C EE F0 C3 35
2D8D:18 18 30 30 00 60 00 00 84	2FED:00 00 00 00 00 00 00 4C	324D:C3 E0 33 60 A8 3E 5B 9F CC
2D95:00 00 55 AA FF AA 55 55 EF	2FF5:00 00 00 00 00 00 00 63	3255:ED 60 5E EB A3 9B A6 D7 04
2D9D:AA FF AA 55 00 00 00 14 0C	2FFD:20 20 20 00 00 00 00 78	325D:BF F8 E6 CC 3F 26 EF C3 BF
2DA5:69 69 7D 7D 69 69 14 10 BF	3005:00 3B 00 00 E6 C0 00 3B A9	3265:A7 9B 00 EC EC 33 BC 3C 3D
2DAD:64 B9 64 14 19 6E 19 16 41	300D:00 00 00 00 00 00 00 6D	326D:00 C9 FC CF E5 F0 3B E6 31
2DB5:5A 6B BF FE E9 A5 94 14 23	3015:00 00 00 00 00 00 0E C0 52	3275:AC 26 EA F0 FB 3E C0 0C 8C
2DBD:69 BE BE BE BE 69 14 00 04	301D:00 39 B0 00 0E C0 00 00 55	327D:03 00 63 55 00 00 00 25
2DC5:00 50 50 00 00 00 00 00 3E	3025:00 00 00 00 00 00 00 85	
2DCD:50 00 00 00 00 05 00 00 64	302D:00 00 00 3B 00 00 E6 C0 CF	
2DD5:00 40 10 04 01 00 00 28 B2	3035:00 3B 00 00 00 00 00 64	
2DDD:96 00 00 00 00 00 00 00 83	303D:00 00 63 E6 F9 B0 E6 F9 D2	
2DE5:00 00 00 00 00 00 00 00 40	3045:B0 39 BE 6C 39 BE 6C 0E 96	
2DED:1B 00 00 00 01 D8 00 1E 5F	304D:6F 9B 0E 6F 9B 39 BE 6C B0	
2DF5:00 00 00 FF 00 00 00 00 50	3055:39 BE 6C E6 F9 B0 E6 F9 58	
2DFD:00 06 0E 03 03 06 0E 0E 26	305D:B0 E6 F9 B0 E6 F9 B0 E6 81	
2E05:0E 0E 0E 0E 0E 0E C2 C0 7D	3065:F9 B0 39 BE 6C 39 BE 6C 34	
2E0D:C0 C3 C3 C3 C3 C3 0A 0A BA	306D:0E 6F 9B 0E 6F 9B 39 BE 20	
2E15:05 05 10 33 CA 0A 0A 05 02	3075:6C 39 BE 6C E6 F9 B0 E6 60	
2E1D:05 80 00 F8 0A FF 05 05 0B	307D:F9 B0 63 0F FF 00 15 55 E3	
2E25:80 00 00 00 00 00 8F 00 E0	3085:50 2A AA A8 0F FF FF 00 F0	
2E2D:00 00 00 00 01 01 01 00 97	308D:E6 00 00 98 00 03 6E C0 94	
2E35:FF FF FF 00 00 00 00 00 91	3095:0E 79 B0 35 A0 EC EE C9 25	
2E3D:00 00 00 00 01 FF 00 00 A1	309D:3B A9 85 26 EE C9 3B 35 63	
2E45:01 FF 00 00 01 FF 00 13 3D	30A5:A0 EC 0E 79 B0 03 6E C0 1A	
2E4D:92 9A 20 53 54 41 47 45 4E	30AD:00 98 00 00 E6 00 0F FF 89	
2E55:20 9F 31 20 20 20 20 20 B3	30B5:FF 2A AA A8 15 55 50 0F 2E	
2E5D:20 20 9A 48 49 9F 20 20 D2	30BD:FF 00 63 00 00 00 00 8A	
2E65:20 20 20 20 20 20 20 20 C1	30C5:00 03 FF C0 0E AA B0 39 A8	
2E6D:20 20 9A 31 55 50 9F 20 93	30CD:55 6C 39 AA 6C E6 FF 9B 60	
2E75:20 20 20 20 20 20 20 20 D1	30D5:E6 C3 9B E6 3C 9B E6 EB 86	
2E7D:9B 5F 5F 5F 20 20 20 20 43	30DD:9B E6 D7 9B E6 EB 9B E6 7F	
2E85:20 20 20 20 20 20 12 9A 40	30E5:3C 9B E6 C3 9B E6 FF 9B 78	
2E8D:20 53 45 43 54 49 4F 4E 60	30ED:39 AA 6C 39 55 6C 0E AA D9	
2E95:20 50 49 20 92 FF 02 02 DB	30F5:B0 03 FF C0 00 00 00 00 7B	
2E9D:03 02 01 02 02 02 01 59	30FD:00 00 63 00 00 00 00 4C	
2EA5:03 02 01 02 02 02 01 41	3105:03 B0 00 0E BC 00 3E 6F C7	
2EAD:02 02 02 02 02 01 03 09	310D:C3 F9 9E BE B6 ED 69 7B 4B	
2EB5:01 01 04 05 01 01 02 02 B5	3115:3E 96 BC F3 EB CF BC 3C 67	
2EBD:02 02 02 02 03 02 00 02 1E	311D:3E 7B C3 ED BC 3C 3E F3 1C	
2EC5:01 03 01 02 01 01 03 01 B6	3125:EB CF 3E 96 BC ED 69 7B 8E	
2ECD:01 02 02 02 03 03 01 04 B5	312D:9E BE B6 6F C3 F9 BC 00 DB	
2ED5:02 05 03 01 03 01 01 03 06	3135:3E B0 00 0E C0 00 03 00 CF	
2EDD:03 01 00 01 03 02 02 02 32	313D:00 00 63 30 03 00 EF 0E 15	
2EE5:02 02 01 03 02 02 02 02 32	3145:F0 BF CF BC E6 BE 6C FB EB	
2EED:02 01 01 04 02 02 05 EC	314D:BB BF 3E EF BB 0F 9B FC 92	
2EF5:02 02 02 03 00 02 02 02 52	3155:03 EE B0 03 FF EC 0E EB F6	
2EFD:03 03 01 01 02 02 01 03 B9	315D:BF 2F BE 6F 3E 6F BF 0F 78	
2F05:01 01 02 02 02 02 01 A1	3165:BF BF 0E FB BC 09 BE 6C 1C	
2F0D:03 01 01 02 02 02 01 78	316D:3E EF BC 3B FE F0 E6 F9 B9	
2F15:04 05 00 02 00 01 03 03 E3	3175:B0 EF FE EC 30 EF F0 00 FD	

TYPING AIDS

MLX, the machine language entry program for the 64 and 128, and *The Automatic Proofreader* are utilities that help you type in Gazette programs without making mistakes. These labor-saving utilities are on each Gazette Disk and printed in issues of Gazette through June 1990.

If you don't have access to a back issue or to one of our disks, write and we'll send you free copies of both of these handy utilities. We'll also include instructions on how to type in Gazette programs. Please enclose a self-addressed, stamped envelope.

Write to Typing Aids, COMPUTE!'s Gazette, 324 West Wendover Avenue, Greensboro, North Carolina 27408.



PROGRAMS

R. B. COOK

If you enjoy a good game of solitaire from time to time, then try your hand at *Line-Up*. This intriguing game of numbers will keep you entertained for hours.

In *Line-Up*, a deck consisting of 50 cards (five colored sets numbered 0-9) is randomly laid out in five rows. The object is to rearrange the cards so that they're in ascending numerical order in rows of the same color.

Getting Started

Line-Up is written entirely in BASIC. To prevent typing errors, use *The Automatic Proofreader* to type it in. See "Typing Aids" elsewhere in this section. When you've finished typing, be sure to save a copy of the program.

To play a round, simply load and run the program. After a brief pause, the cards are shuffled and dealt for the first game.

Playing the Game

Line-Up's numbered cards are grouped into five different colors—red, blue, green, purple, and cyan. There are also 5 blank yellow cards. At the start of a game, the cards are dealt in five rows of 11 cards each. Your goal is to arrange the cards in each row by color while at the same time placing them in ascending numeric order, beginning with 0. You do this by repeatedly swapping a blank card with a numeric card.

Your current position is marked by a large, target-shaped cursor that appears on one of the blank cards. To move the cursor to the next available blank card, press the space bar. You can move to any one of the five blank cards unless it follows a 9 card or another blank card.

When you're ready to move a card, press Return. The blank card will change positions with the numeric card that's the same color as and one number higher than the card just to the left of the blank. For example, if the card to the left of the blank card is a red 4, then the blank card will be exchanged with the red 5. Using this process, you can eventually move the

cards into the correct order.

If you attempt to swap a card at the beginning of a row, you'll be asked to select a color with which to start the row. Press R (red), G (green), B (blue), P (purple), or C (cyan). After you've chosen the color, the 0 card in that color is exchanged with the blank card.

LINE-UP

LOOKING FOR A
NICE, QUIET GAME
OF SOLITAIRE? *LINE-UP*
FOR THE 64 MAY BE
JUST WHAT THE
DOCTOR ORDERED.

When no more swaps are possible, the program reshuffles the remaining cards. You have five deals to place the cards in order before the game ends.

Line-Up

```
HQ 10 REM COPYRIGHT 1990 COMPU
    TE! PUBLICATIONS, INC. -
    ALL RIGHTS RESERVED
AE 20 GOSUB 680:GOSUB 620:GOSUB 4
    70
DQ 30 PL=0:FORL=RWTO4:FORK=CLT
    010
KJ 40 IFLO (L,K) < 50 THEN 110
DG 50 IFK > 0 THEN IFRIGHTS (STR$ (L
    O (L,K-1)), 1) = "9" OR LO (L,K
    -1) > 49 THEN 110
QA 60 PL=1:T=K*24+27:IFT>255TH
    ENT=T-256
EQ 70 POKESX,T:POKESM,-(K>9):P
    OKESY,L*24+116:POKEVL,0:
    POKEVL,15:POKESP,1
AH 80 POKE198,0:WAIT198,1:GETG
    $
FG 90 IFG$=CHR$(13) THEN GOSUB 29
    0:MV=MV+1
ED 100 POKESP,0
EA 110 NEXT:NEXT:IFPLTHEN 30
PQ 120 NC=0:LC=0:FORL=0TO4:FOR
    K=0TO10
```

```
MD 130 IFK > 0 THEN IFLO (L,K-1) + 1 <
    > LO (L,K) THEN 150
PK 140 IFVAL (RIGHT$ (STR$ (LO (L,
    K)), 1)) = K AND LO (L,K) < 50 T
    HEN 160
MD 150 TB (L) = K:FORJ=KTO10:DK (N
    C) = LO (L,J):NC=NC+1:NEXT
    :K=10
QE 160 NEXT:NEXT:IFNC=50RD=5T
    HEN 180
XA 170 GOSUB 470:GOTO 30
BK 180 SC=0:FORL=0TO4
BF 190 IFLO (L,0)/10 > INT (LO (L,0
    )/10) THEN 220
HC 200 T=5-VAL (LEFT$ (STR$ (LO (L
    ,0)), 2))
QS 210 SC=SC+TB (L)*T*10-(TB (L)
    =10)*100
HS 220 NEXT
BS 230 SC=SC-MV*5-DL*100:IFSC<
    0 THEN SC=0
KC 240 IFSC>HSTHENHS=SC
FQ 250 PRINT "{HOME}{4 DOWN}"CL
    S:PRINTTAB (8) "{UP}{YEL}
    SCORE {WHT}"SCTAB (22-(HS
    <1000)) "{YEL}HIGH {WHT}"
    HS
KM 260 FORL=0TO5:GOSUB 440:GOSU
    B 450:NEXT
PB 270 PRINTTAB (8) "{DOWN}PRESS
    ANY KEY TO REPLAY"
DD 280 POKE198,0:WAIT198,1:SH=
    0:DL=0:MV=0:GOSUB 620:GO
    SUB 470:GOTO 30
ER 290 IFK > 0 THEN T=LO (L,K-1)+1:
    GOTO 340
MS 300 PRINT "{HOME}{6 DOWN}"CL
    S:PRINTTAB (14) "{UP}
    {YEL}WHICH COLOR? {UP}":
    GOSUB 450
QR 310 POKE198,0:WAIT198,1:GET
    G$
JM 320 FORJ=1TO5:IFG$<>MID$ ("R
    BGPC",J,1) THEN NEXT:GOSU
    B 420:GOTO 310
EX 330 T=J*10-10:PRINTCL$
JC 340 POKESP,0:FORJ=0TO4:FORH
    =0TO10
EH 350 IFLO (J,H) < > T THEN NEXT:NE
    XT
PK 360 PRINTLEFT$ (CD$,9+L*3)TA
    B (K*3+3)CC$ (LO (J,H))TH$
    CD$ (LO (J,H))BH$
BF 370 PRINTLEFT$ (CD$,9+J*3)TA
    B (H*3+3) "{YEL}"TH$CD$ (5
    0)BH$:GOSUB 400
PD 380 T=LO (L,K):LO (L,K)=LO (J,
    H):LO (J,H)=T
PX 390 RETURN
PR 400 POKEAT,10:POKESR,73:POK
    EWV,17:POKEHF,50:POKELF
    ,0
EA 410 FORI=1TO333:NEXT:POKEWV
    ,16:RETURN
PX 420 POKEHF,5:POKEAT,0:POKES
```




PROGRAMS

[illegible]



PROGRAMS

H U B E R T C R O S S

Your 64's Sound Interface Device (SID) chip is a very capable instrument. It can play up to three sounds at once, each with its own envelope. It can also filter the voices and combine them synthetically for enhanced effects.

Now, *Sound Master* offers you even greater control over the SID chip. With this sound-effects editor, you can completely program the first 160 jiffies of each sound. (A jiffy is 1/60 second.) For instance, you can start a sound with a sawtooth waveform on voice 1, change it to a noise waveform 10 jiffies later, turn on the filter 5 jiffies later, and finally turn on voice 2. While all this is going on, you can also continuously change each voice's frequency and pulse width or the filter frequency and resonance.

When you've finished designing, *Sound Master* saves your sounds to disk or creates an interrupt-driven sound routine you can add to your own programs. For greater flexibility, *Sound Master* lets you place this routine anywhere in memory and include up to 32 separate sounds with it.

Getting Started

This article assumes that you have some familiarity with the SID chip. If you need further information on programming sound on the 64, *Mapping the 64* (by Sheldon Leemon) and *All About the Commodore 64, Volume 2* (by Craig Chamberlain), from COMPUTE Books, and *The Commodore 64 Programmer's Reference Guide* are excellent places to start. If you don't have any experience with the SID chip, you may also want to read Larry Cotton's "BASIC for Beginners" column in the July and August 1989 issues of *Gazette*.

To use *Sound Master*, first type it in using *MLX*, a machine language entry program. See "Typing Aids" elsewhere in this section. Load and run *MLX*. When *MLX* prompts you, respond with the values given below.

Starting address: 0801
Ending address: 1F38

When you've finished typing in the program, be sure to save a copy to disk.

To get started, plug a joystick into port 2 and then type LOAD "filename",8, where filename is the name that you used when you saved the program. To activate *Sound Master*, type RUN and press Return. The program's main screen will appear with the following menu options.

(L)oad File
(S)ave File
(E)dit File
(C)lear Sound
(Q)uit to BASIC
(M)L Routine

SOUND MASTER

CREATE AND EDIT
COMPLEX SOUND
EFFECTS WITH THIS
DYNAMIC MACHINE
LANGUAGE SOUND
EDITOR FOR THE 64

The first two options, Load and Save, allow you to store and recall the sound files that you've created. When you press L or S, *Sound Master* prompts you for a filename. Enter the name of the sound file you wish to load or save. If you're loading a file, *Sound Master* searches the disk in drive 8 for the file you've requested. If you're saving, it stores the file on the disk in drive 8. In either case, a disk error will cause the program to

prompt you with the message *Disk Error: Try again? (Y/N)*. If you respond by pressing Y, *Sound Master* tries the load or save again; otherwise, it returns you to the menu.

Editing Sounds

Pressing E from the main menu places you in the sound editor. The editor's main screen contains a list of the available edit screens and the number keys used to access them (see the following table).

Available Edit Screens

- 1 Voice 1 Frequency
- 2 Voice 2 Frequency
- 3 Voice 3 Frequency
- 4 Voice 1 Pulse Width
- 5 Voice 2 Pulse Width
- 6 Voice 3 Pulse Width
- 7 Filter Frequency
- 8 Filter Resonance
- 9 Sound Points

To begin editing, press 1, 2, or 3 to set the frequency for a specific voice. If you've already loaded a sound file, you'll see a line drawn across the bottom of the screen, indicating how the sound changes over the 160-jiffy time interval. If you're programming a new sound, the frequency will be undefined. The first point at the left side of the screen represents the first jiffy of your sound; the point on the far right represents the 160th jiffy.

In addition to the frequency line, you'll also see a pointer on the screen. Press the joystick left or right to move the pointer over the range of the sound interval. To raise or lower the frequency, press the joystick up or down, respectively.

The frequency line always follows the pointer as you move it about the screen. You can anchor it at a particular point by pressing the fire button. After you've defined a few points, press the space bar to hear the new sound. (If you haven't loaded another sound or haven't set some of the other parameters, you may not hear anything.)



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If you change your mind about a point you've set, press the S key until the pointer is on the point that you want to change. Then press M to move it using the joystick, or press the Del key to remove it entirely.

Editor Commands

Screens 1-8

Keypress	Function
S	Select point
M	Move point
Del	Delete point
Run/Stop	Exit to main menu
Space bar	Play sound
1-9	Display screens 1-9
Fire	Add point to line

Screen 9

Keypress	Function
Crsr keys	Move around windows
+/-	Increment/decrement parameter
I	Copy to buffer
O	Restore from buffer
S	Select sound point
Space bar	Play sound
Run/Stop	Exit to main menu
1-8	Display screens 1-8
Shift-	
Clr/Home	Clear parameter windows
Fire	Pick up/place points

You don't have to define a voice's frequency for every jiffy of the time interval; it can begin and end at any time. You can even leave the frequency undefined for the entire interval.

The other edit screens, selected with keys 4-8, allow you to set a voice's pulse width or the filter frequency and resonance for all three voices. Each of these edit screens is similar to the one just described, and each has a joystick and keyboard interface for setting the parameters.

Creating Your Own Sounds

Edit screen 9, Sound Points, lets you define the remaining sound parameters for each voice. Again, the joystick and keyboard are your interface for entering points, only this time, there are four parameter windows associated with each point and additional keystrokes for fine-tuning each voice.

To set a sound point, use the cursor keys to move around the parameter windows; then use the + and - keys to change the parameter values. When the parameters are set to your

liking, press the joystick left or right to position the point along the time interval and press the fire button to set it.

If you want to see the contents of an existing point, select it with the S key and then press the fire button. This deletes or picks up the point and copies its contents to the parameter windows. You can restore the point by pressing the fire button again without moving the joystick.

To save the contents of the parameter windows to a temporary buffer—the Into buffer—press I. Press O to restore the values to the windows or press Shift-Clr/Home to clear them.

To test your sound at any time, press the space bar. A sound note appears at the left edge of the screen (time = 0 jiffies) and moves toward the right border (time = 159 jiffies). The note may disappear before it reaches the right border if the program determines that there are no more changes in the sound. (This doesn't mean that the sound has finished playing, it only means that there are no more changes to be made to the sound.) The note won't appear at all if the only changes for your sound occur at the left edge of the screen.

If you press the space bar several times in rapid succession, as many as three notes will begin moving across the screen. (Until the first three sounds finish playing, any additional keypresses are ignored.) This is because *Sound Master* can handle up to three different sounds at once. If you're careful while creating your sounds, you'll be able to activate all three voices at the same time without conflicts.

When you set a parameter for a sound point and then play the sound, that parameter is sent to the SID chip even if it's the same value sent by a previous point. To pass a parameter through a point without changing it, set it to the blank or no-change position. For most sound points, you'll probably leave most of the parameters blank. For example, say you'd set the voice 1 gate, wave, attack, decay, sustain, and release values at the beginning of a sound and later turn off the gate to start the release cycle of the sound. The best way to accomplish this is to set only the gate parameter in the second sound point. The remaining parameters don't need to be

changed and should be left blank. If you follow this advice you'll also save a lot of memory when you create a sound routine.

When you're ready to exit the sound editor, press Run/Stop. Pressing this key at any time during the editing process will return you to the main menu.

More Menu Options

The next two menu options, Clear Sound and Quit to BASIC, allow you to clear the current sound from memory and exit the program, respectively. Be careful with these commands because a single keystroke could wipe out hours of hard work.

The last menu option, ML Routine, allows you to combine several sounds into a stand-alone sound routine. Before you begin, be sure that you have saved on disk all of the sounds that you want to use and know what their filenames are. Once you've done that, press M at the main menu.

Sound Master prints the number of the sound that you're loading (you can place up to 32 in one sound-routine file) and asks for the first filename. Enter the name of the sound file and press Return. After the file loads, the program asks ADD MORE SOUNDS?. Press Y to add more sounds to the file or N to continue.

When you've finished selecting sound files, *Sound Master* prompts you for the starting address of the sound routine. Enter a value in the range 512-53248. Next, type the filename for the sound-routine file and press Return. The program will save the file and return you to the main menu.

To play the sounds from a sound-routine file, load it from disk with a command similar to LOAD "filename",8,1. Next, activate the sound routine with SYS start, where start is the starting address of the sound routine. To begin playing a sound, POKE 2,n, where n is the sound number (1-32). As we mentioned earlier, you can have up to three sounds active at the same time; any sounds activated after the first three are ignored.

The sound routine is short and should work with most other programs. However, it won't work with programs that use locations 2 and 3 or locations 886-1023. Also, programs



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that redirect the IRQ interrupt vector may not work with *Sound Master*.

Sound Master

```
0801:0A 08 00 00 9E 32 30 36 6C
0809:31 00 00 00 A9 22 8D FE A1
0811:FF A9 08 8D FF FF D0 22 29
0819:68 85 01 68 A8 68 AA 68 0A
0821:40 48 8A 48 98 48 A5 01 6B
0829:48 A9 08 48 A9 19 48 08 97
0831:48 48 48 A9 37 85 01 4C 39
0839:23 0A 78 A9 23 8D 14 03 81
0841:A9 0A 8D 15 03 58 20 74 D9
0849:10 20 96 12 20 4E 10 20 D7
0851:B8 14 20 E2 1D A9 87 20 B3
0859:17 11 A9 C7 20 17 11 A2 0D
0861:04 BD F7 08 9D F8 8B 9D E7
0869:F8 CB A9 01 9D 27 D0 A9 03
0871:55 A9 08 CA 10 EB A9 FC 4A
0879:A0 08 20 1E AB A9 45 CD 1E
0881:36 1F F0 06 8D 36 1F 20 96
0889:4C 19 20 E4 FF C9 4C D0 E8
0891:06 20 E3 18 4C 77 08 C9 C4
0899:4D D0 09 20 DD 19 20 4C 87
08A1:19 4C 77 08 C9 53 D0 06 04
08A9:20 27 19 4C 77 08 C9 45 30
08B1:D0 12 20 68 18 20 55 09 2E
08B9:20 ED 17 20 75 12 20 81 EF
08C1:FF 4C 60 08 C9 43 D0 24 92
08C9:A9 D8 A0 08 20 4B 1B D0 AE
08D1:A5 20 4C 19 4C 77 08 D0 35
08D9:41 52 45 20 59 4F 55 20 9C
08E1:53 55 52 45 3F 20 28 59 B3
08E9:2F 4E 29 00 C9 51 D0 9A 1A
08F1:20 DF 17 4C 44 E5 1C 1D C0
08F9:1E 1E 1E 93 11 20 12 4C 17
0901:92 4F 41 44 20 46 49 4C 95
0909:45 D0 20 12 53 92 41 56 E3
0911:45 20 46 49 4C 45 D0 20 DC
0919:12 45 92 44 49 54 20 53 4B
0921:4F 55 4E 44 D0 20 12 43 8E
0929:92 4C 45 41 52 20 53 4F 5D
0931:55 4E 44 D0 20 12 51 92 59
0939:55 49 54 20 54 4F 20 42 37
0941:41 53 49 43 D0 20 12 4D 80
0949:92 4C 20 52 4F 55 54 49 A2
0951:4E 45 D0 00 20 01 14 20 CA
0959:41 12 20 A2 1D A9 07 8D E9
0961:20 D0 A9 00 8D 21 D0 20 9F
0969:B4 A9 A9 00 A0 3D 9D D0 98
0971:9D 88 10 FA 85 72 20 68 C4
0979:18 38 66 F0 4C 86 09 8A 82
0981:60 C9 03 F0 FB 20 8C 09 28
0989:4C 82 09 20 E4 FF AA C9 CB
0991:3A B0 EC C9 31 90 E8 E9 AE
0999:30 C5 72 F0 E2 85 71 68 0B
09A1:68 20 86 D0 A9 00 8D 15 0F
09A9:D0 A6 72 E0 09 F0 06 20 62
09B1:09 0B 4C BF 09 20 B4 0A CC
09B9:20 41 12 20 89 14 20 C3 11
09C1:13 A6 71 86 72 E0 09 F0 B7
09C9:03 20 40 0B 20 41 12 A6 E7
09D1:71 20 E4 09 20 89 14 A5 C6
09D9:71 C9 09 F0 03 4C BF 0E 1E
09E1:4C 5C 0B 48 BD 10 0A 8D E6
09E9:7B 13 8E 00 0A A2 0C 86 C9
09F1:63 A0 27 A9 20 20 6C 13 CA
09F9:20 24 13 88 10 F7 A2 00 B5
0A01:BD 19 0A 85 62 BD 26 1C 46
0A09:BC 34 1C 20 AF 13 68 60 09
0A11:22 55 66 22 55 66 44 44 8B
0A19:77 0C 0C 0C 0B 0B 0C D4
0A21:0C 0E A2 02 BD 7B 03 95 AA
0A29:57 20 8F 0A E8 E0 05 D0 29
0A31:F3 EE 27 D0 EE 28 D0 AD 54
```

```
0A39:00 DC 85 03 46 03 B0 03 08
0A41:20 7B 0A 46 03 B0 03 20 EA
0A49:78 0A 46 03 B0 03 20 6A 51
0A51:04 46 03 B0 03 20 67 0A D8
0A59:46 03 66 8E A5 28 30 50 85
0A61:20 8D 0A 4C B1 0A A9 01 F8
0A69:2C A9 FF 18 65 57 C9 A0 3C
0A71:B0 04 85 57 46 28 60 A9 42
0A79:01 2C A9 FF 18 65 5C C9 27
0A81:68 90 08 C9 C8 B0 04 85 22
0A89:5C 46 28 60 A2 00 8A 0A 9C
0A91:A8 B5 57 69 0B 0A 99 00 9C
0A99:D0 AD 10 D0 3D 01 1C 90 47
0AA1:03 1D F9 1B 8D 10 D0 B5 73
0AA9:5C 18 69 32 99 01 D0 60 15
0AB1:4C FC 1D A2 00 8E EE 0A 1B
0AB9:BD BA 0E 8D 7B 13 BD A6 40
0AC1:0E 8D DC 0A BD AB 0E 8D C2
0AC9:DA 0A BD B0 0E 8D E5 0A 0D
0AD1:BD B5 0E 8D EA 0A A9 20 BF
0AD9:A2 01 A0 09 20 6C 13 20 1D
0AE1:24 13 C8 C0 1F D0 F5 E8 03
0AE9:E0 B0 D0 EE A2 00 BD A6 71
0AF1:0E 85 62 8D A1 13 BD AB 14
0AF9:0E 85 63 BD 22 1C BC 30 E9
0B01:1C 20 8F 13 AE EE 0A 60 F5
0B09:A6 72 F0 FB E0 09 F0 F7 F1
0B11:AD 27 7B 48 24 6F 30 08 03
0B19:CE 27 7B 20 08 10 A6 72 12
0B21:AD 27 7B 9D 27 7B 8A 18 75
0B29:69 7B 8D 35 0B A0 00 B9 6C
0B31:30 7B 99 30 7B C8 D0 F7 0D
0B39:68 8D 27 7B 4C 08 10 BD E3
0B41:27 7B 8D 27 7B 8A 18 69 8D
0B49:7B 8D 51 0B A0 00 B9 30 04
0B51:7B 99 30 7B C8 D0 F7 38 FA
0B59:66 6F 60 A9 5B 85 5C 78 47
0B61:20 8D 0A 58 A2 01 20 B6 C1
0B69:0A E8 E0 05 D0 F8 A9 1F 08
0B71:8D 15 D0 A9 80 8D 8A 02 99
0B79:20 C1 D0 A2 0E A0 09 A9 8A
0B81:33 20 24 13 A0 16 A9 34 D3
0B89:20 24 13 A0 23 A9 35 20 6F
0B91:24 13 A9 04 85 A3 A9 00 02
0B99:85 FE 20 A4 0D 24 8E 30 C6
0BA1:05 78 20 F1 0C 58 20 8C 0A
0BA9:09 F0 F2 C9 03 F0 24 C9 69
0BB1:20 D0 21 20 BA 0B 4C 9E 6B
0BB9:0B A9 77 8D C1 17 8D 37 44
0BC1:1F A9 1F 8D C2 17 8D 57 73
0BC9:1F 20 F7 14 A9 01 8D 9B BF
0BD1:1E 85 02 60 A4 FE A6 A3 B0
0BD9:C9 91 D0 05 CA E0 D0 90 28
0BE1:1B C9 11 D0 05 E8 E0 D0 C1
0BE9:90 12 C9 1D D0 05 C8 C0 C4
0BF1:03 90 09 C9 9D D0 0F 88 42
0BF9:C0 03 B0 A1 84 FE 86 A3 32
0C01:20 A4 0D 4C 9E 0B C9 2D 9A
0C09:D0 1F 20 F6 D0 A4 A3 BD C4
0C11:DD 9D 10 0C 38 E9 01 D9 87
0C19:29 16 B0 2A A9 00 F0 26 59
0C21:B9 99 0E 38 E9 01 4C 47 F4
0C29:0C C9 2B D0 24 20 F6 D0 C8
0C31:A4 A3 BD DD 9D 10 0C 18 77
0C39:69 01 D9 99 0E 90 07 A9 85
0C41:00 F0 03 B9 29 16 9D DD 4C
0C49:9D 29 7F 20 2A 0E 4C 9E 2D
0C51:0B C9 49 D0 0E A2 1E BD 8C
0C59:DD 9D 9D FC 9D CA 10 F7 7B
0C61:4C 9E 0B C9 4F D0 0E A2 C1
0C69:1E BD FC 9D DD 9D CA E3
0C71:10 F7 20 C1 0D C9 93 D0 37
0C79:10 A2 1E A9 00 9D DD 90 70
0C81:CA 10 FA 20 C1 0D 4C 9E DD
0C89:0B C9 53 D0 1A A5 06 F0 75
0C91:16 E6 FD A6 FD E4 06 90 B8
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0C99:04 A2 00 86 FD 20 6A 0D 17
0CA1:85 57 78 20 8D 0A 58 4C F4
0CA9:9E 0B E4 06 F0 2C A5 F7 4C
0CB1:85 F9 A5 F8 85 FA A5 F9 AC
0CB9:18 69 20 85 F9 90 02 E6 91
0CC1:FA A0 1F B1 F9 91 F7 88 0D
0CC9:10 F9 A5 F7 18 69 20 85 C8
0CD1:F7 90 02 E6 F8 E8 E4 06 F3
0CD9:D0 DC C6 06 60 A0 1F B1 40
0CE1:F7 99 DC 9D 88 D0 F8 20 6B
0CE9:AB 0C 20 C1 0D 4C 0F 0D BF
0CF1:20 42 0D B0 E8 A6 06 E0 26
0CF9:40 B0 32 A0 1F B9 DC 9D E5
0D01:91 F7 88 D0 F8 A5 57 91 9E
0D09:F7 E6 06 A9 02 2C A9 00 48
0D11:85 8F A5 61 48 A9 A0 20 E6
0D19:2F 0D A9 E0 20 2F 0D 68 91
0D21:85 61 AD 00 DC 29 10 F0 A8
0D29:F9 A9 80 85 8E 60 85 61 75
0D31:A5 57 85 22 85 24 A9 58 2F
0D39:85 23 85 25 E6 25 4C 57 9D
0D41:11 A9 27 85 F7 A9 73 85 5E
0D49:F8 A5 06 F0 1A A2 00 A0 15
0D51:00 B1 F7 C5 57 F0 11 A5 79
0D59:F7 18 69 20 85 F7 90 02 D3
0D61:E6 F8 E8 E4 06 D0 E8 18 F5
0D69:60 A9 00 85 F8 8A A0 05 AE
0D71:0A 26 F8 88 D0 FA 69 27 2E
0D79:85 F7 A5 F8 69 73 85 F8 B5
0D81:A0 00 B1 F7 60 78 A5 57 29
0D89:48 A6 06 CA 30 10 8E 9B 59
0D91:0D 20 6A 0D 85 57 20 0C 2E
0D99:0D A2 00 4C 8C D0 68 85 96
0DA1:57 58 60 20 F6 0D 20 2A E1
0DA9:0E A5 B4 0A 0A 69 0F 85 05
0DB1:58 A5 B5 0A 0A 85 5D 99
0DB9:A2 01 78 20 8F 0A 58 60 2C
0DC1:A5 FE 48 A5 A3 48 A2 0C 61
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0DD1:0D 20 2A 0E C6 FE 10 F6 E9
0DD9:C6 A3 A5 A3 C9 04 B0 EA D9
0DE1:A0 00 84 FE 20 F6 D0 20 E3
0DE9:2A 0E C6 A3 10 F6 68 85 62
0DF1:A3 68 05 FE 60 A5 A3 C9 43
0DF9:04 B0 0D A9 14 85 B4 A5 44
0E01:A3 AA 18 69 04 85 B5 60 35
0E09:A5 FE 0A 05 FE 8D 1D 0E C5
0E11:0A 8D 1F 0E 0A 65 FE 69 A7
0E19:09 85 B4 A9 00 69 00 65 57
0E21:A3 AA A5 A3 69 0B 85 B5 0E
0E29:60 A5 B4 85 62 A5 B5 85 68
0E31:63 BD DD 9D 30 02 A9 18 F8
0E39:29 7F A8 B9 4E 0E 20 02 67
0E41:13 B9 67 0E 20 02 13 B9 0D
0E49:80 0E 4C 02 13 32 32 32 CA
0E51:32 32 32 32 32 32 32 32 6D
0E59:32 32 32 32 32 32 32 32 70
0E61:37 2A 29 29 31 20 32 32 FB
0E69:32 32 32 32 32 32 32 32 85
0E71:33 33 33 33 33 33 33 33 65
0E79:2C 21 2E 37 32 23 20 32 BD
0E81:33 34 35 36 37 38 39 3A 95
0E89:3B 32 33 34 35 36 37 34 8E
0E91:20 26 30 28 23 20 37 20 F7
0E99:92 92 92 92 92 92 92 92 61
0EA1:90 90 92 92 92 92 92 92 01
0EA9:0E 1B 00 04 0E 0E 0E 1F B7
0EB1:18 0D 1A 27 0A 08 18 18 8B
0EB9:18 33 44 22 55 66 A9 50 41
0EC1:A2 98 AC 27 7B F0 06 B9 C2
0EC9:30 7B BE 85 7B 85 57 86 34
0ED1:5C 20 42 10 20 65 0F A9 CB
0ED9:1D 8D 15 D0 20 8C 09 C9 A6
0EE1:03 D0 03 4C 09 0B C9 20 01
0EE9:D0 09 20 09 0B 20 BA 0B 9E
0EF1:4C DD 0E C9 4D D0 06 20 E3
```




PROGRAMS

0EF9:DF	0F	4C	24	0F	C9	14	D0	2E	1159:86	66	86	67	A0	FF	B5	24	34	13B9:FF	20	02	13	30	03	E8	D0	89
0F01:05	20	DF	0F	A9	53	C9	53	18	1161:38	F5	22	B0	09	48	98	95	9C	13C1:F5	60	AD	00	DD	C9	95	D0	C2
0F09:D0	19	E6	2A	A4	2A	CC	27	E3	1169:66	68	49	FF	69	01	95	64	E0	13C9:06	20	53	14	4C	D6	13	20	AA
0F11:7B	90	04	A0	00	84	2A	B9	BB	1171:CA	10	EB	A5	65	C5	64	90	70	13D1:57	14	A9	B0	2C	A9	F0	8D	60
0F19:30	7B	85	57	B9	85	7B	85	B4	1179:36	85	69	E6	69	4A	85	9A	CD	13D9:F0	13	A9	D0	8D	ED	13	A5	6F
0F21:5C	46	28	A5	8E	30	2C	78	64	1181:24	67	10	03	20	E8	11	20	A8	13E1:01	48	A9	00	85	01	A2	0F	54
0F29:AC	27	7B	C0	54	B0	23	B9	48	1189:FB	11	C6	69	D0	01	60	E6	8F	13E9:A0	00	B9	40	D0	99	40	B0	B9
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0F39:D0	F8	F0	16	EE	27	7B	AC	35	1199:08	38	E5	65	B0	04	28	90	57	13F9:13	CA	D0	EE	68	85	01	60	21
0F41:27	7B	A5	57	99	30	7B	A5	26	11A1:E6	24	28	85	9A	A5	22	18	65	1401:A9	B1	A2	00	9D	00	88	9D	5A
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0F59:DD	0E	A9	80	85	28	20	65	99	11B9:24	66	10	03	20	E8	11	20	A0	1419:CA	9D	E8	CA	E8	D0	E5	A9	D7
0F61:0F	4C	DD	0E	AC	27	7B	A5	55	11C1:FB	11	C6	69	D0	01	60	E6	C7	1421:A0	8D	33	14	A9	E0	8D	36	C6
0F69:57	99	30	7B	A5	5C	99	85	AE	11C9:22	A5	9A	18	65	65	85	9A	A1	1429:14	A2	20	A0	00	A9	00	78	31
0F71:7B	20	0B	10	A9	00	85	29	39	11D1:08	38	E5	64	B0	04	28	90	7F	1431:99	00	A0	99	00	E0	C8	D0	B9
0F79:A6	29	EC	27	7B	B0	56	BC	4D	11D9:E6	24	28	85	9A	A5	23	18	9F	1439:F7	EE	33	14	EE	36	14	CA	04
0F81:DA	7B	CC	27	7B	D0	04	A5	C4	11E1:65	67	85	23	4C	C0	11	A2	9D	1441:D0	EE	20	57	14	78	A9	22	FE
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0F91:B9	85	7B	85	23	BC	DB	7B	F4	11F1:FF	18	69	01	95	66	CA	10	43	1451:58	60	A9	B0	D0	02	A9	F0	D0
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0FA1:0C	E6	29	A6	29	EC	27	7B	D5	1201:BD	F5	1B	8D	33	12	49	FF	32	1461:A5	01	48	A9	00	85	01	A9	02
0FA9:B0	2B	BC	DB	7B	B9	30	7B	DE	1209:A6	8F	3D	3D	12	8D	35	12	23	1469:0F	85	04	A0	00	B9	40	B0	1D
0FB1:85	24	B9	85	7B	85	25	A9	11	1211:78	A5	01	48	A9	00	85	01	D8	1471:AA	BD	1B	9E	99	40	D0	C8	E3
0FB9:02	85	8F	A2	02	B5	22	C9	4B	1219:A6	23	BD	70	85	18	79	30	C7	1479:D0	F3	EE	70	14	EE	77	14	4B
0FC1:A0	B0	0D	B5	23	C9	C8	B0	DB	1221:84	85	F7	BD	38	86	79	D0	63	1481:C6	04	D0	E9	68	85	01	60	82
0FC9:07	CA	CA	10	F0	20	57	11	40	1229:84	65	61	85	F8	A0	00	B1	69	1489:20	80	13	8D	A2	14	49	40	55
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0FD9:0A	58	20	41	12	60	AC	27	BD	1239:85	01	58	60	00	55	AA	FF	1C	1499:00	85	01	A2	20	A0	00	B9	AA
0FE1:7B	88	30	F9	B9	30	7B	C5	D0	1241:AD	00	DD	C9	95	F0	0E	C9	EA	14A1:00	A0	99	00	E0	C8	D0	F7	E8
0FE9:57	D0	F6	B9	85	7B	C5	5C	64	1249:94	F0	1D	A9	00	85	61	20	70	14A9:EE	A2	14	EE	A5	14	CA	D0	47
0FF1:D0	EF	C8	B9	30	7B	99	2F	FA	1251:D3	13	4C	78	12	A9	E0	C5	F3	14B1:EE	68	85	01	4C	46	14	A0	70
0FF9:7B	B9	85	7B	99	84	7B	CC	4F	1259:61	F0	05	85	61	4C	D6	13	60	14B9:0B	B9	DD	14	99	71	9D	B9	5A
1001:27	7B	D0	EE	CE	27	7B	20	C6	1261:A9	A0	85	61	20	7B	12	4C	A8	14C1:EB	14	99	D1	9D	88	10	F1	55
1009:42	10	A9	80	85	6F	A2	00	BA	1269:D3	13	A9	B0	85	61	20	78	E9	14C9:A0	53	B9	89	9D	4A	99	7D	AD
1011:86	04	F0	1F	BC	DA	7B	B9	87	1271:12	4C	D6	13	A2	04	2C	A2	DD	14D1:9D	B9	29	9D	6A	99	1D	9D	C7
1019:30	7B	BC	DB	7B	D9	30	7B	A4	1279:05	2C	A2	06	BD	E1	1B	8D	19	14D9:88	10	EF	60	1E	18	8B	7E	35
1021:90	10	F0	19	BD	DA	7B	48	D5	1281:11	D0	BD	B4	1B	8D	16	D0	74	14E1:FA	06	AC	F3	E6	8F	F8	2E	73
1029:98	9D	DA	7B	68	9D	DB	7B	FC	1289:BD	E7	1B	8D	18	D0	BD	EA	2D	14E9:86	8E	96	9F	AD	B3	BD	C8	1E
1031:66	04	E8	EC	27	7B	D0	CB	17	1291:1B	8D	00	DD	60	A9	30	8D	1C	14F1:D4	E1	EE	FD	00	00	AD	C1	D7
1039:A5	04	30	D2	60	46	6F	10	6B	1299:F7	12	A9	84	8D	F8	12	A0	D0	14F9:17	8D	F5	14	AD	C2	17	8D	45
1041:F1	A2	00	8A	9D	DA	7B	E8	E3	12A1:27	A9	F8	18	69	08	20	F0	01	1501:F6	14	A2	01	A9	30	85	F7	21
1049:E0	55	D0	F7	60	A2	00	A9	FF	12A9:12	88	10	F7	A0	1F	A9	00	4F	1509:8A	18	69	7B	85	F8	A9	85	4C
1051:00	85	04	A0	03	8A	39	F1	04	12B1:20	F0	12	88	10	FA	A0	07	A1	1511:85	F9	8A	18	69	7B	85	FA	8E
1059:1B	F0	04	38	F9	70	10	05	FD	12B9:A9	01	20	F0	12	88	10	FA	D3	1519:A9	DA	85	FB	8A	18	69	7B	42
1061:04	85	04	10	EF	A5	04	7D	90	12C1:A9	C7	A2	18	A0	07	18	69	3D	1521:85	FC	A9	00	48	68	DD	27	49
1069:9D	1B	9E	E8	D0	E1	60	40	90	12C9:38	18	69	01	20	F6	12	88	D6	1529:7B	90	1B	E8	E0	09	90	D4	48
1071:10	04	01	A2	00	BD	9B	10	23	12D1:10	F7	CA	10	EF	A9	FE	A2	1D	1531:A2	00	F0	0B	8A	48	20	6A	9B
1079:49	FF	20	85	10	20	85	10	B6	12D9:05	A0	03	18	69	01	18	69	73	1539:0D	20	D6	15	68	AA	E8	E4	C2
1081:E8	10	F2	60	A0	04	38	26	2A	12E1:01	20	ED	12	88	10	F7	CA	AC	1541:06	90	F1	4C	11	17	A8	C8	94
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1091:A5	04	8D	00	8C	EE	94	10	90	12F1:F3	12	20	F6	12	8D	30	84	B3	1551:A8	BD	F7	8D	7E	15	20	C0	5D
1099:68	60	00	00	00	07	57	6B		12F9:EE	F7	12	D0	03	EE	F8	12	BA	1559:17	BD	A4	16	20	C0	17	A9	50
10A1:55	00	07	44	47	00	07	46	20	1301:60	48	8E	1F	13	8C	21	13	4D	1561:C7	38	F1	F9	A8	B9	1D	9D	5F
10A9:47	00	07	46	44	00	05	57	36	1309:A6	63	A4	62	20	24	13	E6	B4	1569:8D	8C	15	20	C0	17	B9	7D	75
10B1:55	00	07	22	27	00	05	76	39	1311:62	A5	62	C9	28	90	06	A9	F3	1571:9D	8D	93	15	20	C0	17	68	2C
10B9:75	00	04	44	47	00	05	77	15	1319:00	85	62	B6	63	A2	00	A0	A1	1579:A8	B1	F7	38	E9	00	85	6E	AF
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10C9:73	00	07	57	65	00	07	22	55	1329:69	13	29	F7	38	E9	20	0A	99	1589:9D	38	E9	00	85	6B	B9	7D	98
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10D9:72	00	05	57	75	00	05	57	56	1339:29	01	18	69	8C	85	F8	98	D2	1599:B0	0D	A9	00	38	E5	6B	85	4A
10E1:22	00	07	55	57	00	06																				



PROGRAMS

1619:0A	0A	0A	20	C0	17	C8	C0	C4	1879:7B	E8	E0	09	D0	F5	20	D7	C4	1AD9:84	B7	A9	08	AA	A8	20	BA	E6
1621:20	90	BA	60	10	20	40	80	E0	1881:18	85	06	A9	7C	8D	9D	18	E7	1AE1:FF	20	C0	FF	B0	07	A2	08	25
1629:90	90	90	96	90	92	80	80	8D	1889:A9	7C	8D	A3	18	A9	7C	8D	87	1AE9:20	C9	FF	90	05	20	2C	1B	C5
1631:80	80	90	90	90	90	92	80	45	1891:A9	18	A2	01	A0	FF	C8	20	B7	1AF1:F0	D1	A9	D4	8D	FE	1A	A9	DB
1639:80	80	80	90	90	90	90	92	59	1899:D7	18	99	30	7B	20	D7	18	16	1AF9:1D	8D	FF	1A	AD	00	FF	EE	1E
1641:80	80	80	80	90	90	90	18	E5	18A1:99	85	7B	20	D7	18	99	DA	9E	1B01:FE	1A	D0	03	EE	FF	1A	20	53
1649:18	18	18	04	04	05	05	06	0F	18A9:7B	98	DD	27	7B	D0	E7	EE	C9	1B09:D2	FF	AD	FE	1A	CD	C1	17	F0
1651:06	04	04	17	0B	0B	0C	0C	1C	18B1:9D	18	EE	A3	18	EE	A9	18	B6	1B11:AD	FF	1A	ED	C2	17	90	E4	B8
1659:0D	0D	0B	0B	17	12	12	13	99	18B9:E8	E0	09	D0	D7	A2	00	E4	F2	1B19:A9	08	20	C3	FF	20	A2	19	45
1661:13	14	14	12	12	17	EF	DF	6C	18C1:06	F0	12	20	6A	0D	A0	00	3E	1B21:D0	A1	20	A2	1D	20	4C	19	71
1669:BF	7F	FE	0F	0F	F0	0F	F0	71	18C9:20	D7	18	91	F7	C8	C0	20	A0	1B29:4C	0B	19	20	CC	FF	A9	6C	93
1671:FB	FD	FE	FE	0F	0F	F0	0F	90	18D1:D0	F6	E8	D0	EA	60	AD	00	86	1B31:A0	1B	20	4B	1B	F0	08	68	4C
1679:F0	FB	FD	FD	FE	0F	0F	F0	FF	18D9:8D	EE	D8	18	D0	03	EE	D9	73	1B39:68	20	A2	1D	4C	4C	19	60	F7
1681:0F	FB	FD	FB	00	00	00	00	B0	18E1:18	60	20	61	19	F0	23	A2	C5	1B41:A9	8B	A0	1B	20	4B	1B	F0	4A
1689:00	00	FF	80	40	80	40	00	42	18E9:08	A0	01	20	BA	FF	A9	00	91	1B49:EE	60	20	1E	AB	20	E4	FF	9C
1691:00	00	00	FF	80	40	80	40	04	18F1:A2	00	A0	8D	20	D5	FF	B0	69	1B51:C9	59	F0	06	C9	4E	D0	F5	60
1699:00	00	00	00	FF	80	40	80	C8	18F9:0E	20	A2	19	D0	09	20	68	72	1B59:C9	59	F0	A9	0D	4C	16	E7	1F
16A1:40	00	00	00	80	87	8E	9D	CA	1901:18	20	BA	0B	4C	0B	19	20	30	1B61:2C	50	2C	57	93	53	4F	55	9A
16A9:A4	AB	B4	B2	99	A0	A7	9B	0F	1909:4C	19	A9	18	A0	19	20	1E	26	1B69:4E	44	00	0D	44	49	53	4B	E1
16B1:A2	A9	AE	B0	A9	00	85	26	F8	1911:AB	20	E4	FF	F0	FB	60	00	03	1B71:20	45	52	52	4F	52	3A	20	D0
16B9:85	27	85	6D	A5	6E	F0	10	D2	1919:50	52	45	53	53	20	41	4E	D1	1B79:54	52	59	20	41	47	41	49	8E
16C1:4A	18	65	6B	85	6B	90	02	79	1921:59	20	4B	45	59	00	20	61	32	1B81:4E	3F	20	28	59	2F	4E	29	82
16C9:E6	6C	A5	6B	05	6C	D0	01	6C	1929:19	F0	DF	A2	08	A0	01	20	2F	1B89:0D	00	0D	45	58	49	54	3F	0C
16D1:60	A0	08	24	6C	30	07	88	54	1931:BA	FF	A9	00	85	F7	A9	8D	E2	1B91:20	28	59	2F	4E	29	0D	00	31
16D9:06	6B	26	6C	10	F9	24	6E	8E	1939:85	F8	A9	F7	AE	5D	18	AC	E8	1B99:0D	41	44	44	20	4D	4F	52	9A
16E1:30	05	C8	06	6E	10	F7	46	CA	1941:5E	18	20	DB	FF	20	A2	19	19	1BA1:45	20	53	4F	55	4E	44	53	1A
16E9:6C	66	6B	46	6E	66	6D	98	38	1949:4C	0B	19	A9	00	8D	5D	18	2B	1BA9:3F	20	28	59	2F	4E	29	0D	34
16F1:30	1D	A5	6B	38	E5	6D	AA	C7	1951:A9	8D	8D	5E	18	A2	09	A9	5A	1BB1:00	0D	51	41	56	45	20	41	F2
16F9:A5	6C	E5	6E	90	4A	86	6B	CA	1959:00	20	5C	18	CA	D0	FA	60	90	1BB9:42	4F	52	54	45	44	0D	00	C9
1701:85	6C	26	26	26	27	B0	07	6A	1961:A9	93	2C	A9	0D	20	16	E7	6A	1BC1:93	53	41	56	45	20	4D	4C	B5
1709:06	6B	26	6C	88	10	E3	60	4D	1969:A9	97	A0	19	20	1E	AB	A0	6D	1BC9:20	52	4F	55	54	49	4E	45	8D
1711:AD	C1	17	38	ED	F5	14	8D	E9	1971:00	20	CF	FF	C9	D0	F0	08	12	1BD1:0D	00	0D	53	54	41	52	54	06
1719:48	17	85	FB	AD	C2	17	ED	36	1979:99	09	9D	C8	C0	10	D0	F1	D4	1BD9:20	41	44	44	52	45	53	53	DE
1721:F6	14	8D	4F	17	85	FC	D0	10	1981:20	5C	1B	F8	F0	0F	AE	09	F1	1BE1:3F	20	00	16	1B	3B	3B	C8	26
1729:09	A5	FB	C9	08	B0	03	4C	B6	1989:9D	E0	20	FF	08	A2	09	A0	53	1BE9:D8	18	15	29	29	97	95	94	5F
1731:BE	17	A5	FB	18	69	04	85	EC	1991:9D	20	BD	FF	98	60	46	49	6E	1BF1:C0	30	0C	03	3F	CF	F3	FC	64
1739:FB	90	02	E6	FC	46	FC	A5	D8	1999:4C	45	4E	41	4D	45	3F	20	3F	1BF9:01	02	04	08	10	20	40	80	34
1741:FB	6A	29	FC	85	FB	A9	00	6C	19A1:00	20	5C	1B	A9	00	85	04	75	1C01:FE	FD	FB	F7	EF	DF	BF	F7	35
1749:38	E5	FB	85	05	A9	00	E5	99	19A9:20	BD	FF	A9	0F	A2	08	A8	B1	1C09:00	00	00	00	00	00	00	01	42
1751:FC	85	04	A9	00	38	E5	05	2C	19B1:20	BA	FF	20	C0	FF	A2	0F	FE	1C11:01	01	01	01	01	02	02	02	50
1759:8D	66	17	AB	F0	02	E6	04	B6	19B9:20	C6	FF	20	E4	FF	A6	04	28	1C19:02	02	02	02	03	03	03	03	60
1761:AD	F5	14	38	E9	00	85	F7	3C	19C1:9D	1B	9F	E6	04	20	D2	FF	32	1C21:03	3E	F8	48	48	48	47	5B	5B
1769:AD	F6	14	E9	00	85	F8	A5	FA	19C9:20	B7	FF	F0	EE	20	CC	FF	9A	1C29:6F	83	99	AF	C5	D8	EB	1C	AD
1771:F7	18	65	FB	85	F9	A5	F8	66	19D1:20	5C	1B	AD	1B	9F	0D	1C	F6	1C31:1C	1D	1D	1D	1C	1C	1C	1C	D9
1779:65	FC	85	FA	38	66	05	B1	11	19D9:9F	C9	30	60	A9	77	8D	C1	62	1C39:1C	1C	1C	1C	1C	2A	2C	23	D0
1781:F7	D1	F9	90	19	F0	17	A2	C5	19E1:17	A9	1F	8D	C2	17	A9	FF	8C	1C41:37	37	BC	0D	33	3C	2F	32	66
1789:04	B1	F7	48	B1	F9	91	F7	3A	19E9:8D	E4	1B	EE	E4	1B	AD	E4	42	1C49:26	22	2B	20	33	20	24	2C	12
1791:68	91	F9	C8	CA	D0	F2	46	E9	19F1:1B	C9	20	90	08	B0	65	20	1F	1C51:23	2B	2E	23	29	22	B1	0D	20
1799:05	98	D0	E3	F0	06	C8	C8	C2	19F9:4C	19	20	2C	1B	A9	65	A0	4A	1C59:34	3C	2F	32	26	22	23	20	E3
17A1:C8	C8	D0	DB	E6	F8	E6	FA	22	1A01:1B	20	1E	AB	A9	00	AE	E4	D8	1C61:34	20	24	2C	23	2B	2E	23	48
17A9:C6	04	D0	D3	A5	FC	D0	82	D8	1A09:1B	E8	20	CD	BD	20	5C	1B	D8	1C69:29	22	B1	0D	35	3C	2F	32	F0
17B1:A5	FB	C9	08	90	03	4C	33	C7	1A11:4C	1A	1A	20	4C	19	20	2C	6A	1C71:26	22	23	20	35	20	24	2C	4A
17B9:17	A5	05	10	F9	A9	FC	8D	7C	1A19:1B	20	64	19	F0	35	A2	08	AA	1C79:23	2B	2E	23	29	22	B1	0D	48
17C1:77	1F	EE	C1	17	D0	0A	EE	6C	1A21:A0	01	20	BA	FF	A9	00	A2	DE	1C81:36	3C	2F	32	26	22	23	20	0D
17C9:C2	17	AD	C2	17	C9	73	B0	78	1A29:00	A0	8D	20	D5	FF	B0	C7	11	1C89:33	20	2A	2E	28	37	23	20	10
17D1:01	60	20	4C	19	20	A2	1D	0D	1A31:20	A2	19	D0	C2	AE	E4	1B	04	1C91:30	26	32	2D	A5	0D	37	3C	90
17D9:20	DF	17	4C	35	A4	08	78	7C	1A39:AD	C1	17	9D	37	1F	AD	C2	C5	1C99:2F	32	26	22	23	20	34	20	FE
17E1:A9	31	8D	14	03	A9	EA	8D	46	1A41:17	9D	57	1F	20	68	18	20	38	1CA1:2A	2E	28	37	23	20	30	26	13
17E9:15	03	28	60	A9	00	8D	5D	34	1A49:F7	14	AE	E4	1B	E8	8E	9B	D7	1CA9:32	2D	A5	0D	38	3C	2F	32	0F
17F1:18	A9	8D	8D	5E	18	A2	01	BA	1A51:1E	86	02	A9	99	A0	1B	20	B6	1CB1:26	22	20	20	35	20	2A	2E	98
17F9:BD	27	7B	20	5C	18	E8	E0	38	1A59:4B	1B	F0	8F	A9	C1	A0	1B	C1	1CB9:28	37	23	20	30	26	32	2D	E5
1801:09	D0	F5	A5	06	20	5C	18	8																		



PROGRAMS

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1D39:32 26 22 23 20 35 3D 3D 1A
1D41:3D 3D 3D 3D 3D BD 00 20 E5
1D49:20 2F 32 26 22 23 0D 3E FD
1D51:21 2D 23 3D 3D 3D BD 0D 07
1D59:30 21 2F 23 3D 3D 3D BD 23
1D61:0D 21 2D 2D 21 22 27 3D FF
1D69:BD 0D 32 23 22 21 31 3D 73
1D71:3D BD 0D 37 2E 37 2D 21 98
1D79:26 29 BD 0D 2C 23 28 23 FA
1D81:21 37 23 BD 0D 2C 26 29 E8
1D89:3E 3D 3D 3D BD 0D 37 31 6F
1D91:29 22 3D 3D 3D BD 0D 24 83
1D99:26 28 2D 23 2C 3D BD 0D A7
1DA1:00 A2 D6 A0 1D 8A 18 69 16
1DA9:26 8D 08 1D 98 69 00 8D 3F
1DB1:DD 1D 8A 18 69 60 8D AF 8C
1DB9:1E 98 69 01 8D B0 1E 8A 5C
1DC1:18 69 80 8D B5 1E 98 69 0C
1DC9:01 8D B6 1E 8E D4 1D 8C 2F
1DD1:D5 1D 60 D6 1D 78 A9 FC D2
1DD9:8D 14 03 A9 1D 8D 15 03 27
1DE1:58 A2 7F A9 00 9D 80 03 F5
1DE9:CA 10 FA A9 0F 8D 98 03 6A
1DF1:A2 02 A9 FC 9D 7D 03 CA B6
1DF9:10 FA 60 A2 0E BD 9D 03 D6
1E01:85 03 BD 9E 03 A0 04 4A 4F
1E09:66 03 88 D0 FA 9D 83 03 AF
1E11:A5 03 9D 82 03 8A 38 E9 59
1E19:07 AA 10 E1 AD 97 03 29 9E
1E21:0F 85 03 AD B3 03 29 F0 6E
1E29:05 03 8D 97 03 AD B4 03 0F
1E31:4A 4A 4A 4A 4A 8D 95 03 C9

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1E39:AD B5 03 8D 96 03 A2 18 11
1E41:BD 80 03 9D 00 D4 CA 10 AF
1E49:F7 A2 0E BD 80 03 18 7D 85
1E51:99 03 9D 80 03 BD 81 03 EB
1E59:7D 9A 03 9D 81 03 BD 9D 66
1E61:03 18 7D 9B 03 9D 9D 03 5B
1E69:BD 9E 03 7D 9C 03 9D 9E 2F
1E71:03 8A 38 E9 07 AA 10 D3 4E
1E79:AD B4 03 18 6D AE 03 8D 55
1E81:B4 03 AD B5 03 6D AF 03 1A
1E89:8D B5 03 AD B3 03 18 6D 7C
1E91:B1 03 8D B3 03 A6 02 F0 FB
1E99:25 E0 00 F0 02 B0 1F A0 61
1EA1:02 B9 7D 03 C9 FC F0 05 56
1EA9:88 10 F6 30 11 BD 36 1F 1B
1EB1:99 77 03 BD 56 1F 99 7A B1
1EB9:03 A9 00 99 7D 03 A2 02 BA
1EC1:8E 76 03 AE 76 03 BD 7D E6
1EC9:03 C9 FC F0 5C BD 77 03 74
1ED1:85 02 BD 7A 03 85 03 AE 93
1ED9:76 03 A0 00 B1 02 C9 FC 4C
1EE1:F0 3A DD 7D 03 D0 2F C8 3B
1EE9:B1 02 08 29 7F AA C8 B1 FC
1EF1:02 28 10 0C 9D 80 03 C8 B9
1EF9:B1 02 9D 81 03 18 90 09 FD
1F01:3D 80 03 C8 11 02 9D 80 37
1F09:03 A5 02 18 69 04 85 02 5C
1F11:90 C5 E6 03 B0 C1 BD 7D 9B
1F19:03 18 69 01 9D 7D 03 A5 AA
1F21:02 9D 77 03 A5 03 9D 7A D5
1F29:03 CE 76 03 10 95 A9 00 C5
1F31:85 02 4C 31 EA 00 00 00 A6

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TYPING AIDS

MLX, the machine language entry program for the 64 and 128, and *The Automatic Proofreader* are utilities that help you type in Gazette programs without making mistakes. These labor-saving utilities are on each *Gazette Disk* and printed in issues of *Gazette* through June 1990.

If you don't have access to a back issue or to one of our disks, write and we'll send you free copies of both of these handy utilities. We'll also include instructions on how to type in Gazette programs. Please enclose a self-addressed, stamped envelope.

Write to Typing Aids, COMPUTE's Gazette, 324 West Wendover Avenue, Greensboro, North Carolina 27408.

MICHAEL SEDLEZKY

An evil syndicate has stolen the security numbers for the national defense system and stashed them in their underground vaults. Your job, if you choose to accept it, is to unlock the vaults and recover the stolen numbers. Since the air surrounding the vaults is laced with cyanide gas, you'll need the assistance of a Mobile Datalink Robot—special model MDR007—for the job.

Codebusters is a one-player guessing game that requires deductive reasoning skills and a good memory. In this game, you must use your robot to decode the four security panels that control the lock for each vault. A destruct-timer and a pesty security robot add to the suspense.

Getting Started

Codebusters is written entirely in machine language. To type it in, you'll need *MLX*, a machine language entry program. See "Typing Aids" elsewhere in this section. When *MLX* prompts you, respond with the values given below.

Starting address: 0801
Ending address: 17D0

After you have finished typing in the program, be sure to save a copy of it

CODE- BUSTERS

HERE'S A
CHALLENGING
MEMORY GAME FOR
THE 64 THAT
YOUNGSTERS WILL
REALLY ENJOY.
JOYSTICK REQUIRED.

before exiting *MLX*.

Although written in machine language, *Codebusters* loads and runs like a BASIC program. When you're ready to play, plug your joystick into port 2; then load the program and type RUN.

A title screen will appear. To proceed, press the fire button.

Open the Vault

As the game begins, you find yourself in front of a vault where the missing security numbers are located. Before you are the four separate security panels which must be decoded before the vault doors will open. To decode each panel, you must determine its five-digit access code. To assist you in decoding the panels is a Mobile Datalink Robot, initially located offscreen to the left.

To control the robot, as well as to issue any other commands, use the command line window at the bottom of the screen. To scan through the command line selections, move the joystick up or down. Press the fire button to execute the command shown.

To activate your robot, select the Robot Movement Control command. When you press the fire button, the message *Motor Controls Engaged* will appear on the command line; you can now move the robot. To position the robot in front of one of the four panels' connectors (the connectors are at your robot's eye level, just to the left of each panel), move the joystick left or right. Once the robot is aligned



PROGRAMS

with a connector, disengage the motor-controls command by pressing the fire button. Then, select the Analyzer Hook Up command to connect the robot to the panel.

You're now ready to attempt to decipher the panel's access code. Choose the Enter Code Selection command to select a number using your joystick. A hyphen will appear under the rightmost digit in the access code. To increase or decrease the value of this digit, move the joystick up or down, respectively. To locate the hyphen under another digit, move the joystick left or right. When you've finished entering the five-digit number, press the fire button to activate the command line. Then select the Transmit Data to Panel command to relay your guess to the panel.

The Decode Analyzer evaluates your response and reports back to you with a color code for each digit. If the color is green, then the digit is correct. If it's red, then the correct number is higher. Yellow indicates that the correct digit is lower. When you've correctly identified all five digits, you'll receive 500 points. Toggle the Analyzer Hook Up command to unplug the MDR007 and then move on to the next panel. When you've activated all four panels, the vault doors will open, revealing the stolen security numbers. The value of the security numbers are then added to your score. To advance to the next vault and begin the entire process anew, press the fire button.

Security Alert!

Failing to identify the access codes for the four panels within 50 guesses or within nine minutes ends the game. If, however, you're successful, you can continue on to the next vault. Each time you open a vault, you'll receive 10 bonus guesses. Your current score (middle of the screen), the nine-minute timer (lower left), your high score (upper left), your best time to open a vault (upper right), and the number of guesses remaining (lower right) are all displayed.

Figuring out the access codes is not the only problem you'll encounter in *Codebusters*. Periodically, a security robot will appear and try to unplug the MDR007 from a panel. A red warning light will flash on your on-screen control panel for four seconds before the guard appears. If the guard

is successful in disconnecting your robot, you'll lose five decoding attempts. To prevent this from happening, unplug the MDR007 from the panel yourself. This keeps you from losing any attempts, but it also causes the five-digit number that's currently showing on the decoder to be erased. Therefore, be sure to memorize the code before you disconnect your robot.

If you find that the guard robot comes around too often, you can decrease the frequency of its appearance by POKEing a number between 140 and 255 in location 3319 (the current value is 140). To do this, just load the program, POKE the given value, and then run the program. You can also change the color of your robot in a similar manner; just POKE a given color value (0-15) into location 3378.

Codebusters

```
0801:0C 08 01 00 9E 20 32 38 4B
0809:31 38 00 00 00 21 21 2B B1
0811:2B 2B 25 00 00 00 00 39
0819:00 00 00 00 20 20 20 03 ED
0821:0F 04 05 02 15 13 14 05 9C
0829:12 13 20 20 20 28 03 29 DD
0831:20 31 39 39 30 20 03 0F 6F
0839:0D 10 15 14 05 21 15 01 8F
0841:54 00 07 15 00 07 6A 80 1F
0849:07 9F 0C 07 EA A0 07 EA 20
0851:A4 05 E6 A4 07 D6 97 01 DF
0859:6F 57 07 EE 97 03 EE A4 12
0861:03 AA A4 00 AA 80 00 FF 89
0869:C0 02 66 60 00 FF C0 02 B0
0871:66 60 00 FF C0 00 FF C0 93
0879:00 3F 00 00 08 00 47 00 28
0881:05 50 00 15 34 00 AA 74 E4
0889:00 FD B4 02 AA F4 06 AA AF
0891:F4 06 A6 D4 35 A5 F4 35 1F
0899:7E 50 35 AE F4 06 AE F0 9C
08A1:06 AA B0 00 AA 80 00 FF CC
08A9:C0 02 66 60 00 FF C0 02 F0
08B1:66 60 00 FF C0 00 FF C0 D3
08B9:00 3F 00 00 08 00 47 00 68
08C1:04 00 00 37 00 00 77 40 76
08C9:00 B7 80 02 B7 A0 02 F7 34
08D1:E0 06 D5 E4 05 F7 D4 0E 9C
08D9:5D 6C 0E F7 EC 0E FF EC 81
08E1:02 BF A0 00 AE 80 00 FF 6E
08E9:C0 02 66 60 00 FF C0 02 31
08F1:66 60 00 FF C0 00 FF C0 14
08F9:00 3F 00 00 08 00 47 00 A8
0901:04 00 00 37 00 00 77 40 B7
0909:00 B7 80 02 B7 A0 02 F7 75
0911:E0 06 D5 E4 05 F7 D4 0E DD
0919:59 6C 0E F7 EC 0E FF EC C0
0921:02 BF A0 00 AE 80 00 FF AF
0929:C0 01 99 90 00 FF C0 01 9A
0931:99 90 00 FF C0 00 FF C0 FA
0939:00 3F 00 00 04 00 47 FF C9
0941:FF FF FF FF FF D5 55 57 AC
0949:D5 7D 57 D5 7D 57 D5 AA 8D
0951:57 D5 69 57 D6 AA 97 DA 92
0959:7D A7 D6 AA 97 D5 69 57 D7
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0961:D5 AA 57 D5 7D 57 D5 7D C3
0969:57 D5 7D 57 D5 7D 57 D5 EA
0971:7D 57 D5 55 57 FF FF FF E2
0979:FF FF FF FF FF FF F3 FF 73
0981:FF FF FF FF FF D5 41 57 C4
0989:D5 C3 57 D5 C3 57 D6 82 6B
0991:97 D5 82 57 DA 82 A7 E9 C4
0999:C3 6B DA 82 A7 D5 82 57 DC
09A1:D6 82 97 D5 C3 57 D5 C3 FA
09A9:57 D5 C3 57 D5 C3 57 D5 0D
09B1:C3 57 D5 41 57 FF FF FF 05
09B9:FF FF FF FF FF FF F3 FF B3
09C1:FF FF FF FF FF D5 00 57 82
09C9:D7 00 D7 D7 00 D7 DA 00 55
09D1:A7 D6 00 97 EA 00 AB E7 7D
09D9:00 DB EA 00 AB D6 00 97 90
09E1:DA 00 A7 D7 00 D7 D7 00 E2
09E9:D7 D7 00 D7 D7 00 D7 D7 A1
09F1:00 D7 D5 00 57 FF FF FF 6F
09F9:FF FF FF FF FF FF F3 FF F3
0A01:FF FF FF FF FF D4 00 17 7F
0A09:DC 00 37 DC 00 37 E8 00 EE
0A11:2B D8 00 27 E8 00 2B DC DD
0A19:00 37 E8 00 2B D8 00 27 FB
0A21:E8 00 2B DC 00 37 DC 00 73
0A29:37 DC 00 37 DC 00 37 DC B5
0A31:00 37 D4 00 17 FF FF FF 66
0A39:FF FF FF FF FF FF F3 FF 35
0A41:FF FF FF FF FF C0 00 03 5B
0A49:C0 00 03 C0 00 03 C0 00 B7
0A51:03 C0 00 03 C0 00 03 C0 14
0A59:00 03 C0 00 03 C0 00 03 64
0A61:C0 00 03 C0 00 03 C0 00 CF
0A69:03 C0 00 03 C0 00 03 C0 2C
0A71:00 03 C0 00 03 FF FF FF 76
0A79:FF FF FF FF FF FF F3 FF 75
0A81:00 00 00 00 00 00 00 95
0A89:02 22 00 20 20 20 00 88 33
0A91:00 08 20 80 80 80 00 6A
0A99:A8 00 22 AA 20 02 AA 00 4F
0AA1:03 AB 00 00 EC 00 00 FC 86
0AA9:00 00 30 00 00 30 00 84
0AB1:10 00 01 55 00 01 55 00 F1
0AB9:00 00 00 00 00 00 00 68
0AC1:FF FF FF FF FF FF 55 55 B7
0AC9:F5 55 5F F5 55 5F F5 55 E2
0AD1:5F F6 AA 9F F6 AA 9F F6 3B
0AD9:AA 9F F6 AA 9F F6 AA 9F 82
0AE1:F6 AA 9F F6 AA 9F F6 AA EB
0AE9:9F F5 55 5F F5 55 5F F5 A5
0AF1:55 5F F5 55 5F F5 FF FF 97
0AF9:FF FF FF FF FF FF 00 00 0E
0B01:00 A9 93 20 D2 FF A9 0A E9
0B09:8D 20 D0 A9 00 8D 21 D0 EB
0B11:A2 18 A9 00 9D 00 D4 CA 15
0B19:10 F8 A9 0A 8D 18 D4 A9 6B
0B21:C8 8D 05 D4 8D 06 D4 A9 C4
0B29:21 8D 04 D4 A2 10 BD 2E FF
0B31:08 9D 13 06 BD 1D 08 9D 85
0B39:C3 05 AD FF CF 9D C3 9D 7E
0B41:9D 13 DA CA 10 E8 EE FF F4
0B49:CF AD FF CF 8D 00 D4 A9 0F
0B51:FF 29 0F 8D 01 D4 CE EF 55
0B59:CF D0 08 AD 20 D0 A9 08 46
0B61:8D 20 D0 AD 00 DC 29 10 11
0B69:D0 C2 A2 10 BD 1A D0 9D FB
0B71:00 D0 BD 2B 0D 9D 20 D0 16
0B79:CA 10 F1 A2 07 BD 0E 08 B4
0B81:9D F8 07 CA 10 F7 A9 00 26
0B89:8D 17 D0 8D 1D D0 A9 0F 9E
0B91:8D 15 D0 8D 1C D0 A9 0F 1E
0B99:8D 0E D4 8D 0F D4 A9 08 0D
0BA1:8D 12 D4 A0 27 A9 A0 99 62
0BA9:00 04 99 28 04 99 00 05 23
0BB1:99 B8 05 99 E0 05 99 08 53
0BB9:06 99 30 06 99 58 06 99 73
```




PROGRAMS

0BC1:98	07	99	C0	07	A9	64	99	66	0E21:4C	91	0D	20	96	11	4C	91	8E	1081:40	8D	04	D4	60	FF	08	FF	06	
0BC9:68	05	A9	78	99	50	04	A9	D1	0E29:0D	A9	00	8D	CC	CF	A9	0E	16	1089:07	10	99	F9	FF	0F	FF	07	47	
0BD1:0C	99	90	D9	99	B8	D9	99	01	0E31:8D	FE	CF	AD	04	CF	D0	11	BA	1091:10	72	28	FF	03	FF	07	80	02	
0BD9:E0	D9	A9	00	99	00	D8	99	24	0E39:AD	00	DC	C9	7F	D0	EA	CE	48	1099:F1	F9	FF	09	FF	07	10	A2	A0	
0BE1:28	D8	99	50	D8	99	68	D9	52	0E41:CC	CF	D0	EF	CE	FE	CF	D0	B3	10A1:FD	FF	0F	FF	0A	40	C1	F0	68	
0BE9:99	08	DA	99	30	DA	99	58	3C	0E49:EA	60	AD	E8	CF	D0	06	AD	B2	10A9:AD	FA	CF	D0	01	60	A2	06	3B	
0BF1:DA	99	98	DB	99	C0	DB	8D	C1	0E51:E6	CF	D0	49	60	A9	01	8D	BC	10B1:A9	64	8D	F9	CF	A9	06	8D	CF	
0BF9:04	D4	88	10	A8	A0	05	A9	D4	0E59:BA	CF	20	6C	0F	20	60	13	5E	10B9:18	D4	BD	8D	10	9D	00	D4	77	
0C01:A0	99	89	05	A9	0C	99	89	8B	0E61:A2	1A	BD	CB	14	09	80	9D	2D	10C1:CA	10	F7	A2	04	8E	C5	CF	2A	
0C09:D9	88	10	F3	A9	AD	8D	42	D2	0E69:C7	07	CA	10	F5	AD	00	DC	C8	10C9:AD	04	CF	F0	03	4C	0C	11	3D	
0C11:05	8D	49	05	8D	50	05	8D	CD	0E71:29	10	D0	EC	EE	AB	CD	AD	7E	10D1:AE	C5	CF	A9	AD	9D	18	07	6A	
0C19:58	05	A9	00	8D	42	D9	8D	8A	0E79:AB	CD	C9	0A	D0	03	CE	AB	94	10D9:CE	FE	CF	D0	EB	CE	F9	CF	86	
0C21:49	D9	8D	50	D9	8D	58	D9	9A	0E81:CD	A9	22	8D	F8	07	CE	FF	8D	10E1:D0	E6	AD	E6	CF	F0	01	60	EC	
0C29:A0	10	A9	AD	99	B3	06	99	E6	0E89:CF	D0	F6	CE	00	D0	D0	F1	64	10E9:A9	19	8D	F9	CF	A9	10	8D	49	
0C31:03	07	B9	3A	07	99	DB	06	F3	0E91:AD	07	CF	D0	FB	68	68	20	BF	10F1:04	D4	AD	04	CF	F0	03	4C	D3	
0C39:A9	A0	99	2B	0D	B9	1D	08	95	0E99:C5	16	4C	6B	0B	A9	0B	8D	01	10F9:0C	11	EE	FF	CE	AD	00	DC	4C	
0C41:09	80	99	01	04	A9	A0	99	E2	0EA1:11	D0	A2	06	BD	94	10	9D	2D	1101:8D	FD	CF	C9	7F	F0	EB	29	C0	
0C49:53	07	A9	00	99	B3	DA	9B	EC	0EA9:00	D4	CA	10	F7	A9	0F	8D	67	1109:10	D0	11	AE	C5	CF	A9	A0	D5	
0C51:DB	DA	99	03	DB	99	2B	DB	E8	0EB1:18	D4	A9	81	8D	04	D4	A9	2C	1111:9D	18	07	20	4E	14	A9	0A	0B	
0C59:99	53	DB	88	10	CC	A0	07	13	0EB9:01	8D	27	D0	A9	02	8D	F5	12	1119:8D	18	D4	60	AD	04	CF	F0	B6	
0C61:8C	C1	CF	A9	A0	99	A9	06	89	0EC1:CF	A9	00	8D	FA	CF	8D	FE	3A	1121:03	4C	0C	11	AD	FD	CF	29	98	
0C69:99	D1	06	99	F9	06	99	C6	FE	0EC9:CF	AD	27	D0	49	01	8D	27	BB	1129:02	D0	1A	DE	F4	CF	10	05	BD	
0C71:06	99	C7	06	99	EE	06	99	7A	0ED1:D0	AD	FE	CF	8D	01	D4	29	E1	1131:A9	09	9D	F4	CF	A9	11	8D	42	
0C79:EF	06	99	16	07	99	17	07	73	0ED9:07	09	C8	8D	16	D0	AD	00	FC	1139:04	D4	BD	F4	CF	09	8D	9D	3B	
0C81:99	49	07	A9	00	99	A9	DA	34	0EE1:D0	49	07	8D	00	D0	AD	02	13	1141:F0	06	4C	C9	10	AD	BD	CF	86	
0C89:99	D1	DA	99	F9	DA	88	10	C8	0EE9:D0	49	07	8D	02	D0	CE	FE	6A	1149:29	01	D0	12	FE	F4	CF	BD	A4	
0C91:D2	AD	00	0B	F0	03	4C	BE	1A	0EF1:CF	D0	6D	A9	1B	8D	11	D0	A1	1151:F4	CF	C9	0A	D0	DF	A9	00	15	
0C99:0C	A9	01	8D	AA	CD	8D	00	C2	0EF9:CE	F9	CF	D0	CC	CE	F5	CF	60	1159:9D	F4	CF	4C	36	11	AD	FD	95	
0CA1:0B	A9	00	8D	3C	03	8D	3D	C8	0F01:D0	C7	AD	15	D0	49	01	8D	BB	1161:CF	29	04	D0	12	AE	C5	CF	E9	
0CA9:03	8D	3E	03	8D	3F	03	8D	9B	0F09:15	D0	A2	1A	BD	E7	14	09	9A	1169:A9	A0	9D	18	07	CA	10	01	42	
0CB1:40	03	8D	41	03	A9	05	8D	C6	0F11:80	9D	C7	07	CA	10	F5	A9	6C	1171:E8	8E	C5	CF	4C	C9	10	AD	B8	
0CB9:C1	CF	8D	AB	CD	A2	FF	A9	B5	0F19:80	8D	04	D4	A9	00	8D	0B	1C	1179:FD	CF	29	08	F0	03	4C	C9	2A	
0CC1:00	9D	00	CF	CA	D0	F8	A2	6C	0F21:D4	8D	3C	03	8D	3D	03	8D	B9	1181:10	AE	C5	CF	A9	A0	9D	18	30	
0CC9:13	AD	1B	D4	29	0F	C9	0A	AA	0F29:3E	03	8D	3F	03	8D	40	03	9E	1189:07	E8	E0	05	D0	01	CA	8E	84	
0CD1:B0	F7	9D	D0	CF	09	30	CA	CE	0F31:8D	41	03	8D	00	0B	A9	C8	E7	1191:C5	CF	4C	C9	10	AD	FA	CF	AD	
0CD9:10	EF	A2	03	AD	1B	D4	29	C1	0F39:8D	16	D0	AD	00	DC	29	10	6E	1199:D0	01	60	20	4F	12	A2	06	80	
0CE1:0F	C9	0A	B0	F7	9D	BD	CF	E7	0F41:D0	F9	68	68	20	C5	16	A9	C7	11A1:BD	A2	10	9D	00	D4	CA	10	20	
0CE9:09	30	9D	12	05	A9	07	9D	E1	0F49:00	8D	15	D0	4C	11	0B	AD	E4	11A9:F7	A9	01	8D	18	D4	A9	41	D3	
0CF1:12	D9	CA	10	E7	A9	8C	8D	70	0F51:FF	CF	29	07	AA	BD	05	15	64	11B1:8D	04	D4	A9	FF	8D	FE	CF	D4	
0CF9:E4	CF	8D	08	CF	18	69	02	5E	0F59:AA	A0	00	BD	5F	14	F0	0A	08	11B9:AD	FE	CF	8D	2D	DB	8D	30	69	
0D01:8D	C3	CF	A9	1E	8D	C4	CF	E7	0F61:09	80	99	C7	07	C8	E8	4C	4D	11C1:DB	8D	03	DB	8D	36	DB	8D	E3	
0D09:8D	AD	CE	8D	00	CF	A9	3C	D6	0F69:5C	0F	60	AD	C0	CF	F0	09	90	11C9:39	DB	CE	F9	CF	AD	F9	CF	F1	
0D11:8D	E7	CF	8D	1B	D0	4C	4C	BF	0F71:20	A5	0F	CE	C0	CF	4C	6C	22	11D1:8D	00	D4	8D	02	D4	D0	F2	26	
0D19:0D	07	F3	01	73	35	5C	70	12	0F79:0F	AD	BF	CF	F0	09	20	B4	20	11D9:AD	E6	CF	D0	05	CE	FE	CF	C4	
0D21:5C	AA	5C	E7	5C	20	53	00	28	0F81:0F	CE	BF	CF	4C	7A	0F	AD	E7	11E1:D0	D6	A9	40	8D	04	D4	A9	2B	
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0D31:00	01	02	00	00	00	00	00	CB	0F91:BE	CF	4C	88	0F	AD	BD	CF	8F	11F1:CF	AD	CE	EF	CF	B9	52	15	8A	0C
0D39:00	A0	84	85	83	8F	84	85	4D	0F99:F0	09	20	D2	0F	CE	BD	CF	A2	11F9:B9	D0	CF	AE	EE	CF	DD	F4	79	
0D41:A0	81	8E	81	8C	99	9A	85	7B	0FA1:4C	96	F0	60	EE	41	03	AD	A3	1201:CF	F0	11	B0	21	AE	EE	CF	E7	
0D49:92	A0	00	20	1D	16	20	46	9E	0FA9:41	03	C9	0A	D0	44	A9	00	ED	1209:BD	29	15	AA	A9	07	9D	2D	75	
0D51:13	20	19	14	20	4F	12	20	E3	0FB1:8D	41	03	EE	40	03	AD	00	DF	1211:DB	4C	33	12	CE	ED	CF	AD	75	
0D59:A8	0F	A9	40	8D	0D	CF	A9	AE	0FB9:03	C9	0A	D0	35	A9	00	8D	F7	1219:EE	CF	BD	29	15	AA	A9	05	9E	
0D61:05	8D	0E	CF	20	AA	16	A2	9A	0FC1:40	03	EE	3F	03	AD	3F	03	E2	1221:9D	2D	DB	4C	33	12	AE	EE	CD	
0D69:0A	8E	0C	CF	AD	DB	0D	D0	72	0FC9:C9	0A	D0	26	A9	00	8D	3F	73	1229:CF	BD	29	15	AA	A9	02	9D	B8	
0D71:1C	A9	00	9D	C6	DA	9D	EE	A9	0FD1:03	EE	3E	03	AD	3E	03	C9	5B	1231:2D	DB	88	CE	EE	CF	10	C0	78	
0D79:DA	9D	16	DB	9D	49	DB	9D	50	0FD9:0A	D0	17	A9	00	8D	3E	03	64	1239:AD	ED	CF	D0	03	20	97	12	90	
0D81:A1	CE	CA	10	EC	A9	07	8D	24	0FE1:EE	3D	03	AD	3D	03	C9	0A	95	1241:A9	00	8D	04	D4	A9	0F	8D	25	
0D89:A3	CE	8D	DB	0D	20	8B	17	AF	0FE9:D0	08	A9	00	8D	3D	03	EE	FD	1249:18	D4	20	4E	14	60	CE	AA	02	
0D91:20	2A	0E	D0	50	0F	20	4B	5A	0FF1:3C	03	A2	05	BD	07	10	9D	5B	1251:CD	10	11	A9	09	8D	AA	CD	BE	
0D99:0E	AD	04	CF	F0	10	A9	00	BE	0FF9:3D	06	BD	3C	03	09	8D	9D	EE	1259:CE	AB	CD	D0	05	A9	07	8D	01	
0DA1:8D	04	CF	20	26	10	A2	04	3A	1001:43	06	CA	10	EF	60	93	83	4A	1261:0E	CF	30	22	A9	30	8D	69	3B	
0DA9:20	4F	12	CA	10	FA	AD	00	5E	1009:8F	92	85	A0	A2	0B	BD	11	1E	1269:07	AD	AB	CD	09	30	8D	6A	5D	
0DB1:DC	8D	FD	CF	29</																							



PROGRAMS

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12E1:CF 8D BD CF 09 30 8D 12 3C
12E9:05 AD AB CD 8D BE CF 09 5E
12F1:30 8D 13 05 8D B0 CF A2 B5
12F9:06 BD 86 10 9D 00 D4 CA C3
1301:10 F7 A9 03 8D 18 D4 A2 AB
1309:03 EE AE CF AD AE CF 8D 94
1311:00 D4 A9 21 8D 04 D4 AD 87
1319:B1 CF 8D 01 D4 CE B1 CF E2
1321:D0 E7 A9 20 8D 04 D4 A9 B0
1329:01 8D E8 CF CE B0 CF D0 F6
1331:D8 A9 96 8D B0 CF EE FE 7B
1339:07 CA 10 CD A9 80 8D 04 E2
1341:D4 EE AA CD 60 A9 00 8D F6
1349:F0 CF 8D F1 CF 8D F2 CF 17
1351:8D F3 CF 8D CD CF A9 BA C9
1359:8D D4 06 20 BF 13 60 AD F6
1361:F3 CF CD A3 CE 90 17 F0 41
1369:01 60 AD F2 CF CD A2 CE D6
1371:90 CF F0 01 60 AD F1 CF 7E
1379:CD A1 CE 90 01 60 AD F1 A8
1381:CF 8D A1 CE AD F2 CF 8D 7A
1389:A2 CE AD F3 CF 8D A3 CE 74
1391:A2 09 BD 2E 15 09 80 9D 51
1399:44 04 CA 10 F5 60 A2 00 B3
13A1:A0 05 BD A4 CE DD 3C 03 C4
13A9:F0 03 90 06 60 E8 88 10 43
13B1:F1 60 A2 05 BD 3C 03 9D 10
13B9:A4 CE CA 10 F7 60 AD E8 C5
13C1:CF F0 01 60 EE F1 CF AD BE
13C9:F1 CF C9 0A D0 31 A9 00 55
13D1:8D F1 CF EE F2 CF CE 0D A5
13D9:CF AD F2 CF C9 06 D0 1F D5
13E1:A9 00 8D F2 CF EE F3 CF AF
13E9:CE 0C CF AD F3 CF C9 09 CA
13F1:D0 0C AD A9 00 8D F1 CF 8D 5A
13F9:F2 CF A9 01 8D E6 CF AD 28
1401:F1 CF 09 B0 8D D6 06 AD C3
1409:F2 CF 09 B0 8D D5 06 AD 48
1411:F3 CF 09 B0 8D D3 06 60 7B
1419:A9 06 BD 2D DB 8D 30 DB 6D
1421:8D 33 DB 8D 36 DB 8D 3F A6
1429:DB 4C 3E 14 A9 0E 8D 2D 29
1431:DB 8D 30 DB 8D 33 DB 8D EC
1439:36 DB 8D 39 DB A2 04 A9 D3
1441:00 9D F4 CF A9 B0 9D F0 A8
1449:06 CA 10 F3 60 4C 2A 0E FE
1451:A0 19 B9 38 15 09 80 99 32
1459:C7 07 88 10 F5 60 20 20 CA
1461:12 0F 02 0F 14 20 0D 0F D1
1469:16 05 0D 05 0E 14 20 03 D3
1471:0F 0E 14 12 0F 0C 20 20 51
1479:00 20 20 20 20 20 01 0E 41
1481:01 0C 19 1A 05 12 20 08 AA
1489:0F 0F 0B 20 15 10 20 20 A9
1491:20 20 20 00 20 20 05 9C
1499:0E 14 05 12 20 03 0F 04 BE
14A1:05 20 13 05 0C 05 03 14 95
14A9:09 0F 0E 20 20 00 20 7F
14B1:20 14 12 01 0E 13 0D 09 21
14B9:14 20 04 01 14 01 20 14 7D
14C1:0F 20 10 01 0E 05 0C 20 48
14C9:20 00 10 12 05 13 13 20 DF
14D1:02 15 14 14 0F 0E 20 20 15
14D9:14 0F 20 03 0F 0E 14 09 E5
14E1:0E 15 05 20 20 20 20 DA
14E9:20 20 20 20 20 20 07 01 C0
14F1:0D 05 20 0F 16 05 12 20 DF
14F9:20 20 20 20 20 20 20 22
1501:20 20 20 20 00 1B 36 51 73
1509:6C 87 8C A2 35 70 AA E7 AF
1511:1E 1F 20 56 57 58 8E 8F 44
1519:90 CE CF D0 00 00 00 01 47
1521:01 01 02 02 03 03 03 91
1529:00 03 06 09 0C 0E 05 17 1F
1531:20 12 05 03 0F 12 04 20 A9
1539:20 0D 0F 14 0F 12 20 03 DD

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1541:0F 0E 14 12 0F 0C 13 20 09
1549:05 0E 07 01 07 05 04 20 DE
1551:20 04 09 0E 13 AD FA CF A3
1559:F0 01 60 20 51 14 A9 07 7F
1561:8D 18 D4 A2 06 BD 9F 15 98
1569:9D 00 D4 CA 10 F7 A9 11 6E
1571:8D 04 D4 20 2A 0E AD E6 CB
1579:CF F0 01 60 A9 03 8D 01 63
1581:D4 20 98 15 20 A6 15 AD F5
1589:00 DC 29 10 D0 E8 20 2A A5
1591:0E A9 10 8D 04 D4 60 AD E9
1599:00 DC 8D 18 16 60 FF 03 63
15A1:FF 01 40 73 F9 CE 19 16 9E
15A9:F0 01 60 AD 18 16 29 7F 5E
15B1:49 7F D0 0B CE 1A 16 D0 07
15B9:05 A9 23 8D F8 07 60 AD 60
15C1:00 D0 8D 17 16 AD 18 16 F0
15C9:29 04 D0 24 A9 22 8D F8 CF
15D1:07 A9 07 8D 01 D4 A9 0A 5C
15D9:8D 1A 16 CE 17 16 EE 17 07
15E1:16 D0 03 EE 17 16 CE 17 60
15E9:16 AD 17 16 8D 00 D0 60 3D
15F1:AD 18 16 29 08 F0 01 60 B4
15F9:A9 21 8D F8 07 A9 07 8D FC
1601:01 D4 A9 0A 8D 1A 16 EE A8
1609:17 16 D0 03 CE 17 16 AD 3D
1611:17 16 8D 00 D0 60 00 00 08
1619:00 00 01 01 78 AD 14 03 1B
1621:8D 00 CD AD 15 03 8D 01 79
1629:CD A9 D9 8D 14 03 A9 16 D0
1631:8D 15 03 A9 03 8D 0C D4 9F
1639:A9 17 8D 0D A9 41 8D DF
1641:0B D4 A9 0F 8D 18 D4 58 1D
1649:60 AD 07 CF D0 01 60 AD E7
1651:10 CF F0 0B CE 11 CF D0 73
1659:05 A9 00 8D 10 CF 60 CE 9A
1661:03 CF AD 03 CF 29 01 F0 FE
1669:01 60 AD 28 D0 49 0B 8D B5
1671:28 D0 AD 01 CF 29 01 D0 A1
1679:0D EE 02 D0 AD 02 D0 C9 16
1681:FF F0 0B 4C B0 16 CE 02 8D
1689:D0 F0 03 4C B0 16 AD F9 B2
1691:07 49 03 8D F9 07 AD 01 15
1699:CF 49 01 8D 01 CF CE 07 E4
16A1:CF D0 0B AD 08 CF 8D 00 C0
16A9:CF A9 05 8D 0F CF 60 AD C7
16B1:CF CF D0 01 60 AD 02 D0 09
16B9:CD 00 D0 F0 01 60 A9 01 D3
16C1:8D 04 CF 60 78 AD 00 CD FD
16C9:8D 14 03 AD 01 CD 8D 15 6C
16D1:03 58 A9 00 8D 0B D4 60 6D
16D9:AD 0A CF F0 19 A9 05 8D 6F
16E1:27 D0 CE 0B CF D0 0F A9 E9
16E9:00 8D 0A CF A9 01 8D 27 4B
16F1:D0 A9 10 8D 04 D4 20 4A C9
16F9:16 AD 04 DC 6D FF CE 29 1D
1701:0F 8D FF CE A2 03 BD E9 8D
1709:CF F0 08 BD 29 D0 49 05 5C
1711:9D 29 D0 CA 10 F0 AD E6 A5
1719:CF F0 03 4C 31 EA CE AD 11
1721:CE D0 15 A0 05 AD 0F CF 64
1729:49 08 8D 0F CF 99 4A DB F5
1731:88 10 FA A9 1E 8D AD CE F2
1739:AD E7 CF 8D 07 D4 49 FF 29
1741:29 07 8D 08 D4 8D 09 D4 BB
1749:09 03 8D 0A D4 CE E7 CF 90
1751:F0 1A AD FC CF F0 12 CE 39
1759:CA CF D0 0D A9 14 8D C4 46
1761:CF AD F8 07 49 07 8D F8 EC
1769:07 4C 31 EA A9 3C 8D E7 44
1771:CF CE 0F CF D0 0B A9 02 40
1779:8D 0F CF 8D 07 CF 8D 10 A7
1781:CF 20 BF 13 20 8B 17 4C 72
1789:31 EA A2 10 BD DC 0D 9D 79
1791:1A 04 09 8D CA 10 F5 AD 27
1799:A3 CE 09 B0 8D 24 04 AD 2C

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17A1:A2 CE 09 B0 8D 26 04 AD BB
17A9:A1 CE 09 B0 8D 27 04 A9 43
17B1:BA 8D 25 04 20 9F 13 A2 CD
17B9:11 BD ED 0D 9D 00 04 CA 2E
17C1:10 F7 A2 05 BD A4 CE 09 C1
17C9:B0 9D 0B 04 CA 10 F5 60 3C

```

The Automatic Proofreader

See article on page 24.

```

10 VE=PEEK(772)+256*PEEK(773):
LO=43:HI=44:PRINT "{CLR}
{WHT}AUTOMATIC PROOFREADER
{SPACE}FOR ";
20 IF VE=42364 THEN PRINT "64"
30 IF VE=17165 THEN LO=45:HI=4
6:GRAPHIC CLR:PRINT"128"
40 SA=(PEEK(LO)+256*PEEK(HI))+
6:FOR J=SA TO SA+166:READ B
:POKE J,B:CH=CH+B:NEXT
50 IF CH<>20570 THEN PRINT "E
RROR* CHECK TYPING IN DATA
{SPACE}STATEMENTS":END
60 FOR J=1 TO 5:READ RF,LF,HF:
RS=SA+RF:HB=INT(RS/256):LB=
RS-(256*HB)
70 CH=CH+RF+LF+HF:POKE SA+LF,L
B:POKE SA+HF,HB:NEXT
80 IF CH<>22054 THEN PRINT "E
RROR* RELOAD PROGRAM AND CH
ECK FINAL LINE":END
90 IF VE=17165 THEN POKE SA+14
,22:POKE SA+18,23:POKESA+29
,224:POKESA+139,224
100 POKE SA+149,PEEK(772):POKE
SA+150,PEEK(773):PRINT"
{CLR}PROOFREADER ACTIVE"
110 SYS SA:POKE HI,PEEK(HI)+1:
POKE (PEEK(LO)+256*PEEK(HI)
)-1,0:NEW
120 DATA120,169,73,141,4,3,169
,3,141,5,3,88,96,165,20,133
,167
130 DATA165,21,133,168,169,0,1
41,0,255,162,31,181,199,157
,227
140 DATA3,202,16,248,169,19,32
,210,255,169,18,32,210,255,
160
150 DATA0,132,180,132,176,136,
230,180,200,185,0,2,240,46,
201
160 DATA34,208,8,72,165,176,73
,255,133,176,104,72,201,32,
208
170 DATA7,165,176,208,3,104,20
8,226,104,166,180,24,165,16
7
180 DATA121,0,2,133,167,165,16
8,105,0,133,168,202,208,239
,240
190 DATA202,165,167,69,168,72,
41,15,168,185,211,3,32,210,
255
200 DATA104,74,74,74,74,168,18
5,211,3,32,210,255,162,31,1
89
210 DATA227,3,149,199,202,16,2
48,169,146,32,210,255,76,86
,137
220 DATA65,66,67,68,69,70,71,7
2,74,75,77,80,81,82,83,88
230 DATA 13,2,7,167,31,32,151,
116,117,151,128,129,167,136
,137

```




HOW TO TYPE IN

Each month, Gazette publishes programs for the Commodore 128 and 64. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We regularly publish two programs designed to make typing easier: *The Automatic Proofreader*, for BASIC programs, and *MLX*, for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements, as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off and then on, erasing what was in memory. This could cause you to lose valuable data, so be sure to *save a program before you run it*. If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from Gazette, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor-down key; {5 Spaces} means to press the space bar five times.

To indicate that a key should be shifted (hold down the Shift key while pressing another key), the character is underlined. For example, A means hold down the Shift key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight shifted A's).

If a key is enclosed in special brackets, [] , hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This

can be entered on the Commodore 64 by pressing the Ctrl key while typing the letter in braces. For example, {A} means to press Ctrl-A.

The Quote Mode

Although you can move the cursor around the screen with the Crsr keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is the *quote mode*.

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a graphics symbol for cursor left. In this case, you can use the Del key to back up and edit the line. Type another quotation mark and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing Return. Then cursor up to the mistyped line and fix it. If the mistake involves cursor movement, however, you must press the quote key to reenter quote mode. □

When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL 9	
{OFF}	CTRL 0	
{BLK}	CTRL 1	
{WHT}	CTRL 2	
{RED}	CTRL 3	
{CYN}	CTRL 4	

When You Read:	Press:	See:
{PUR}	CTRL 5	
{GRN}	CTRL 6	
{BLU}	CTRL 7	
{YEL}	CTRL 8	
{F1}	f1	
{F2}	SHIFT f1	
{F3}	f3	
{F4}	SHIFT f3	
{F5}	f5	
{F6}	SHIFT f5	
{F7}	f7	
{F8}	SHIFT f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT ↑	

For Commodore 64 Only		
[1]	COMMODORE	1
[2]	COMMODORE	2
[3]	COMMODORE	3
[4]	COMMODORE	4
[5]	COMMODORE	5
[6]	COMMODORE	6
[7]	COMMODORE	7
[8]	COMMODORE	8